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- Motorola StarTAC With clipOn Organizer
- Toshiba Portégé 3110CT
- L&H Voice Xpress Professional 4.0
- WordPerfect Office 2000
- Cobalt RaQ 2
- Gateway Profile XL

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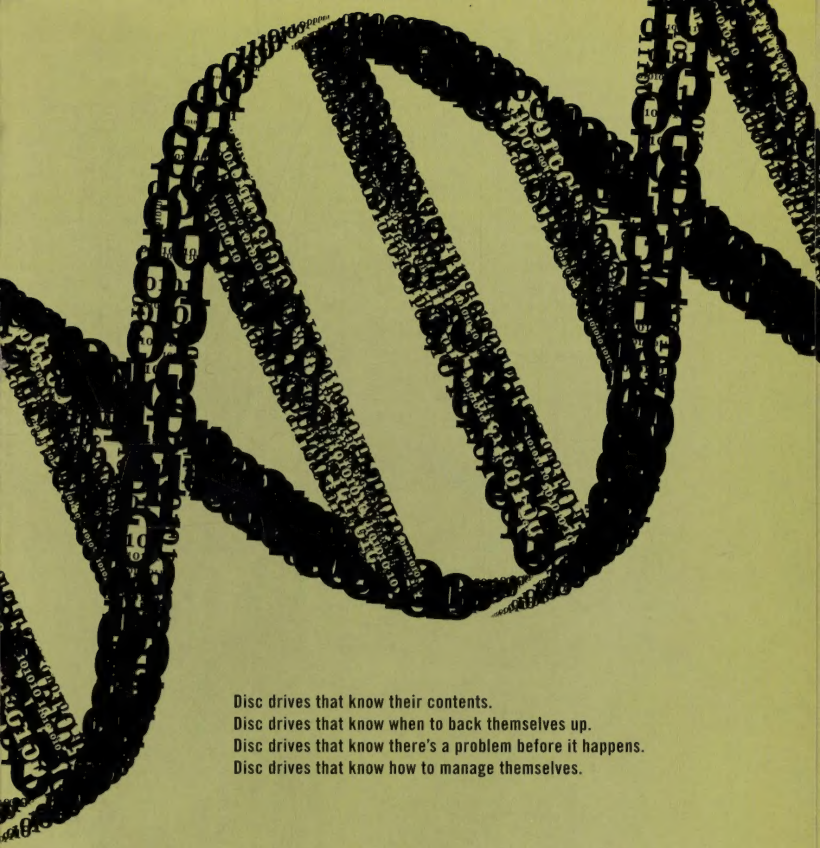

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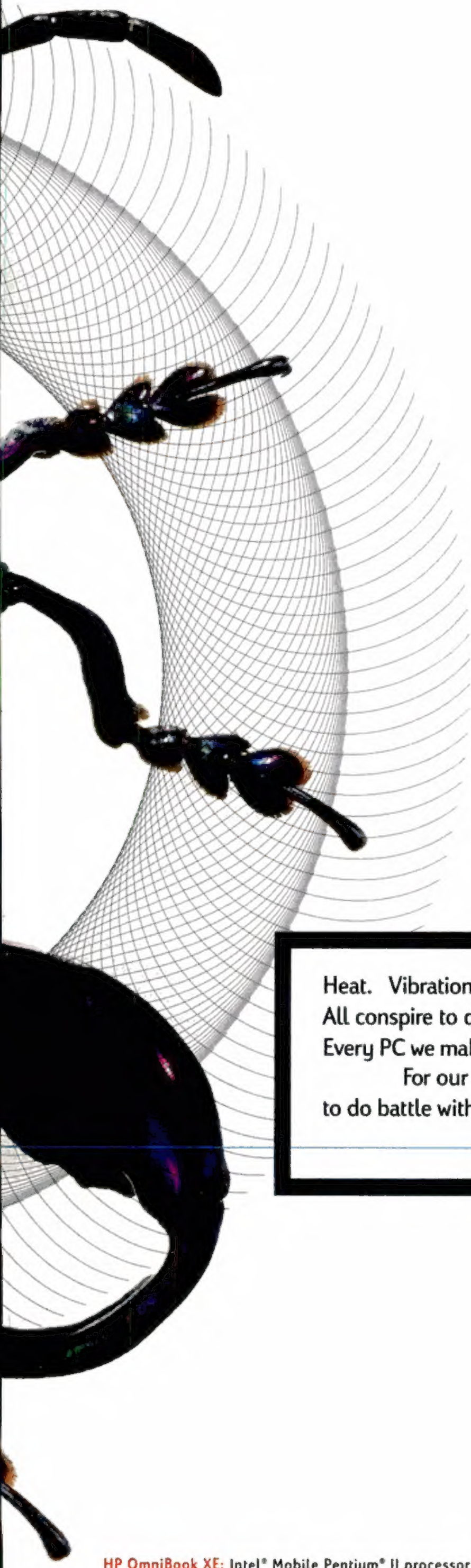

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Data, Data Everywhere

We are now into summer, and it seems as if everyone is traveling somewhere. Some of us are traveling on business; others are just taking a well-deserved vacation. More than ever, many us want—or need—to keep in touch while we're on the road. For better or worse, today's technology gives us lots of ways of keeping connected with our businesses, our families, and the information we need while traveling.

Many of us have been carrying laptops and cell phones for a long time. But now it seems that everywhere I go, I hear cell phones ringing and pagers beeping, and I see people carrying laptop bags.

The trend is just beginning.

In recent weeks, we've looked at all sorts of portable devices, giving you information about the many ways to stay connected no matter where you are. These range from traditional laptops and handheld computers to two-way pagers and smart phones. All sorts of new services are popping up as well, letting you get and send e-mail, faxes, and voice mail messages from almost anywhere.

Any of these devices can be terrific, but which is right for you? The answer depends on the amount of information you need and the frequency with which you need updates.

That's why the concept of convergence—one device that does everything—is probably a pipe dream. Different people have many different needs, so they prefer all sorts of different devices and services.

Personally, I do most of my connecting through a traditional laptop. Much of the most important communication I receive comes in the form of e-mail, with lots of long documents and graphics attached within the body. I typically don't need to respond to everything I get immediately, though I do prioritize the important things. So my laptop has become my primary access device. I like the thin and light design of my notebook, with its great keyboard, big screen, and decent battery life.

This works pretty well, but I find myself looking for phone jacks in too many hotel lobbies and other similar locations. I'd love to be able to get my e-mail wirelessly, and that's probably the next step for me. But thus far I've been disappointed by spotty coverage and high prices. So I'm closely monitoring the new services that communications companies are rolling out.

I carry a cell phone for more urgent communications, and unlike many of my colleagues I don't carry a pager. I've looked at the cell phones colleagues carry that have basic built-in paging features, but they don't meet my needs just yet. When these phones add browsers so I can check news headlines and similar things on the road, they'll be much more attractive to me.

I also carry a Palm hand-held, which keeps my schedule and contacts. It's great, but lately I've been jealous of colleagues who are carrying the Palm VII, with its ability to check information from many Web sources. Devices like this let you check the Internet for news headlines, stock prices, or sports scores, or get an urgent e-mail when you're in a cab or a meeting at a customer's office. I wish the Palm VII let you access your standard mail file in an intelligent way instead of using a special mail address, and I worry a bit about the cost of the service. But I looked at the one we tested for this issue, and I know I have to give it a try.

Laptops may be getting lighter and lighter, but my bag seems to be getting heavier and heavier.

The gadget lover in me can't wait to try all these new devices. But a part of me is worried.

On the simple, practical side, I worry about the number of things I'm carrying. Laptops may be getting lighter and lighter, but my bag seems to be getting heavier and heavier.

And on the strategic side I worry that we may be getting just too dependent on all of these devices. It's one thing to be checking e-mail and headlines on a business trip, but sometimes I wonder about the people who constantly have their cell phones ringing at movies, in restaurants, and on the beach.

We all need data and information, but sometimes you just need time to think about what all that data means. PC

PHOTOGRAPHY BY JAY REED

More on the Web:
Editor-in-chief Michael J. Miller answers your computing questions every Tuesday, exclusively at PC Magazine Online.
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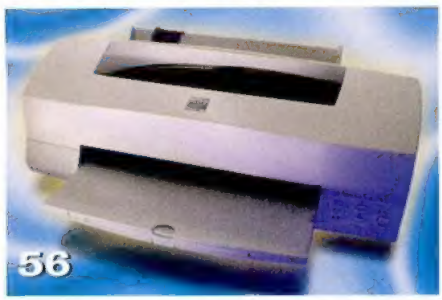

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Cover photography: Marty Umans (top center), Thom O'Connor (top right), Mert Kerim (portables)

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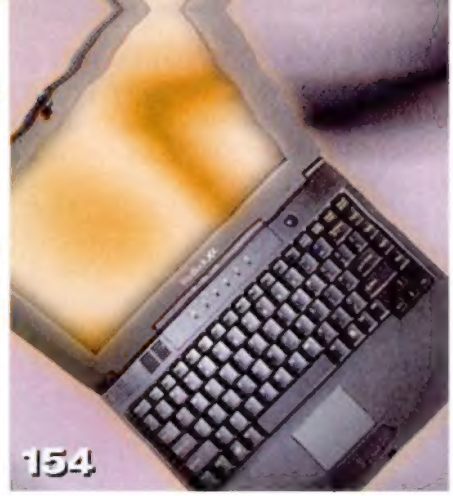

COVER STORY

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These days business doesn't stand still just because you're away from the office. In this special report we review the hardware and services you need to stay connected, no matter where your work takes you.

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This special guide is packed with useful Web sites, important phone numbers, and helpful travel tips. Pull it out and take it with you. *By Bill Howard*

INTERNET

221 SQL Database Servers

Your business is growing, extending to the Web. Your old desktop database can't handle the advanced applications you now need, and you're looking for a SQL database to run your company. We review and preview the latest from IBM, Informix, Microsoft, Oracle, and Sybase. *By Timothy Dyck*

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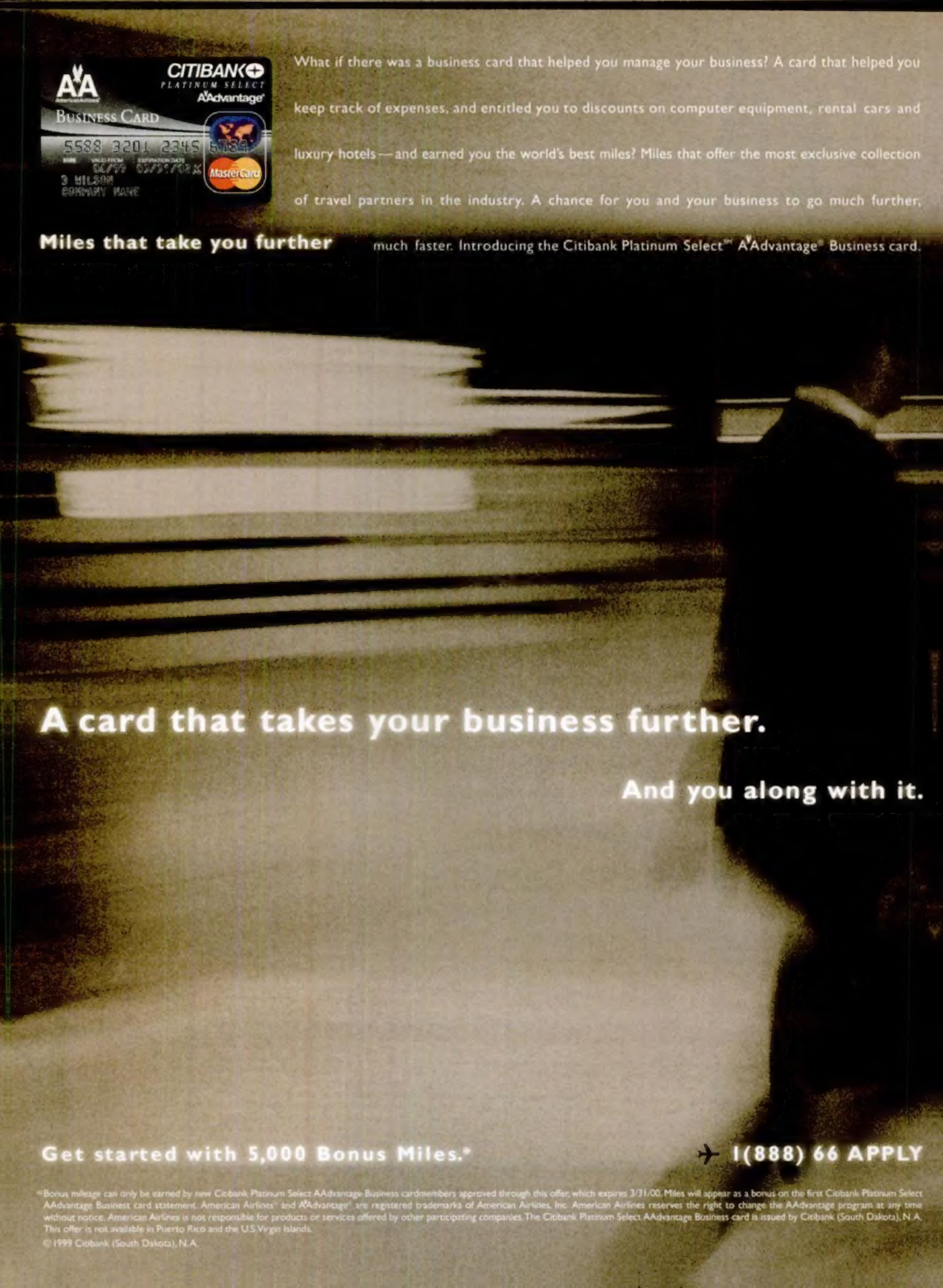

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Talking Back to the TV

Microsoft isn't waiting around for digital TV to sweep the nation. Instead it has its sights set on interactive TV. The Redmond-based software giant recently took a 10 percent stake in Wink Communications, a move Microsoft hopes will boost its role in interactive television and advertising.

Wink, based in Alameda, California, provides interactive TV technologies designed to work over conventional analog cable lines. For example, Wink's technology lets you watch The Weather Channel and pop up dialog boxes showing local weather information.

Through the deal with Microsoft, Wink plans to integrate its interactive TV technologies with upcoming versions of Microsoft's WebTV. Both companies have been studying ways to let television viewers call up information related to broadcasts (calling up related news headlines during the evening news, for example) and to let advertisers conduct interactive promotions in conjunction with TV programming.

To Microsoft, WebTV is a critical platform for interactive TV services. In a recently announced deal, AT&T and Microsoft plan to put WebTV technologies on millions of cable set-top boxes. WebTV currently has about 800,000 subscribers, but Microsoft sees millions of subscribers in the near future. The company would like to see WebTV compete with Internet service providers (ISPs) such as America Online.

Microsoft is likely to face competition from America Online, Intel, and others in the interactive-TV game. AOL recently formed a partnership with DirecPC and DirecTV to deliver interactive TV services.

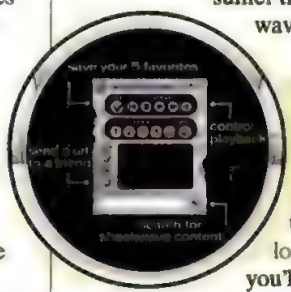
The Software Economy

By the year 2000, the software industry will be contributing more to the U.S. economy than any other manufacturing industry, reports a new study from the Business Software Alliance. In 1998, the software industry employed 806,900 people at an average salary of $68,900, compared with an average of $29,800 for workers in other sectors. By the year 2008, 1.3 million people will work in the software industry, which generated a trade surplus of $13 billion in 1997 and is expected to grow to $20 billion in 2000. On the downside, industry growth was slowed by software theft. The BSA estimates that 25 percent of all software applications in use are illegal.

of respondents to a recent PC Magazine Online poll told us that their families' Web access includes no parental filtering whatsoever. Just 3 percent said they have light filtering, 5 percent reported moderate filtering, and 5 percent said they use a heavy amount of filtering.

What's a Shockmachine?

As a well-known developer of Web graphics software, Macromedia has made the Web entertaining through its programs Director, Flash, and Dreamweaver. Now the company plans to bring its message of an animated, interactive Web directly to the consumer through a new business venture called Shockwave.com, set to launch this summer.



What's Playing: *Macromedia's new Shockmachine delivers comics, music, and games.*

Shockwave is Macromedia's playback format, which lets multimedia entertainment stream over the Internet. Shockwave.com combines a Web site and a small utility called Shockwave Remote, which will make it easier to find and view Shockwave content. You can think of Shockwave.com as a centralized location for entertainment services. For example, you'll be able to play cartoons, comics, music, and games from major entertainment companies, such as Comedy Central, Fox Interactive, Hasbro Interactive, Marvel Comics, and Warner Brothers. You'll also be able to create personal cards and cartoons using well-known characters, such as the cast of the popular animated television show South Park.

Macromedia sees Shockwave.com as a profitable business venture. In addition to the free player, you'll be able to upgrade to a full-fledged entertainment console called Shockmachine. For $19.99, you'll get a whizzy, animated interface. Your purchase of Shockmachine also buys you access to exclusive new releases on Shockwave.com that won't be available to the general public.

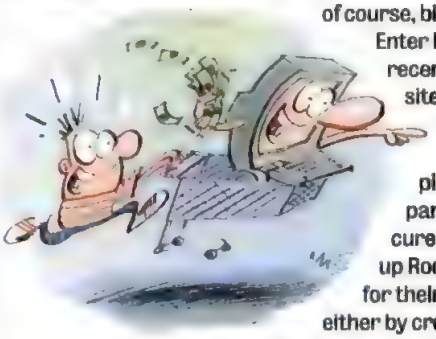
A Robot at Your Service

Advances in robotics technology focus primarily on commercial applications, but a new product aims to put robots in your living room. Cye, a home robot from Probotics, is designed to roam about the house or office, delivering messages, fetching coffee, and even vacuuming. Available in several eye-catching colors, Cye communicates with your PC via a 900-MHz radio link. It can learn its environment gradually, or you can use the included software to map out the floor plans for it. Cye costs $695 list; wagon and vacuum attachments are available for $89 each.

Home Bot: *Cye (above) can be programmed to deliver goods on its wagon (below).*

Online Pocket Money

Everybody knows that some kids today are more plugged in to technology than their parents. Kids teach their parents how to use tax software, how to rip MP3 files, or even just how to plug in the computer. But one aspect of the wired world is leaving kids behind: e-commerce.



Teens make only a tiny fraction of their purchases online, because most shopping sites require credit card information, and most kids don't have cards. Parents are reluctant to hand over their credit cards for many reasons: They want to prevent access to inappropriate shopping sites, security risks caused by kids' handing over personal information, and of course, big bills.

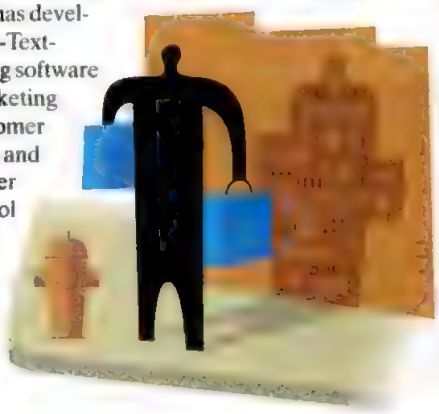
Enter RocketCash, a recently launched Web site that promises 10- to 18-year-olds an online shopping experience that parents can feel secure about. Parents set up RocketCash accounts for their kids, funded either by credit cards or checks, and they have the right to approve which stores their kids can buy from.

ICanBuy also lets kids shop on the Web using funds in online accounts set up by parents. The site also lets kids save money and give to charity.

Smart Summaries

The sheer amount of text circulating on the Web is increasing at an astronomical rate. Analyzing huge volumes of text is a particularly daunting task for marketing managers, who find themselves faced with a sea of information from customers.

With that in mind, a company called Artificial Life has developed the Alife-Smart-Text-Analyzer, data-mining software designed to help marketing pros create Web customer profiles from log files and transcripts of customer conversations. The tool acts like a filter and extracts information from any text. Artificial Life hopes that by automating the process of extracting information from thousands of lines of conversation, marketing professionals can quickly distill a customer's tastes and preferences by identifying major topics discussed. Artificial Life eventually plans to develop a voice recognition version of the tool.



THIS ISSUE'S CONTRIBUTORS: *Carol Levin, Sharon Nash, Sebastian Rupley, Luisa Simone*

ILLUSTRATIONS BY HAL MAYFORTH (TOP) AND DOUG ROSS (BOTTOM); PHOTOGRAPHY BY THOM O'CONNOR

Tush Technology

Back pain is second only to the common cold as a cause of worker absenteeism. And the ache extends to employers as well, who spend $20 billion in workers' compensation annually on the problem. To help alleviate the pain for both, office chair giant Steelcase has come up with the Leap, a high-performance office chair based on research examining how people sit from ergonomists at the University of Vermont, Michigan State University, and Cornell University.

The Leap's flexible back is designed to conform to your individual spinal motion, or your *spineprint;* your spine changes shape as you change positions thoughout the day. According to Steelcase, the flexible back alleviates the "lower-back gap" that occurs when you recline—as your upper-back leans back, your lower-back rotates forward. Steelcase plans to license its technology to airlines.

Top-Selling Edu-ware

1. Kid Pix Studio Deluxe — The Learning Company
2. Jumpstart First Grade — Havas Interactive
3. Blue's ABC Time Activities — GT Interactive
4. Jumpstart Second Grade — Havas Interactive
5. The Rugrats Movie Activity Challenge — The Learning Company
6. Mavis Beacon Teaches Typing 9.0 — The Learning Company
7. Math Shop Deluxe — Scholastic
8. Jumpstart Third Grade — Havas Interactive
9. Jumpstart Preschool — Havas Interactive
10. Oregon Trail II — The Learning Company

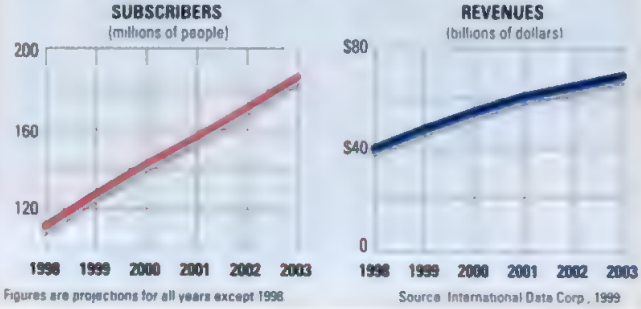
Source: PC Data, May 1999, based on retail sales.

Decaf Java

The big news from the recent JavaOne conference in San Francisco was a new Micro Edition of Sun's Java 2, targeting hand-helds. 3Com is already incorporating the Micro Edition into some of its Palm hand-held devices. It's also expected to show up in Motorola pagers. Alan Baratz, president of Sun's software division, said it was essential for Java to spread out to hand-helds. "These are becoming the alternative to desktop clients," he said, referring to today as the post-PC era.

Wireless Surge

The U.S. wireless-service market, including paging, cellular phone, and satellite services, will continue to prosper, according to a report from International Data Corp. In 2003 the number of wireless-service subscribers is expected to increase to 186 million, with revenues reaching $69 billion.



Figures are projections for all years except 1998

Source: International Data Corp., 1999

My 3 sisters hog every inch of our bedroom, but every day on the Internet I get a billion miles of space.

Tanya, age 9

In South Central Los Angeles, there's not much room for opportunity. That's why Oracle's Promise along with community volunteers put computers, printers, software, and Internet connections into 11 schools in the area. It's part of Oracle's $100 million commitment to education which has placed over 5000 computers in 100 schools around the country, and the world. So far. Help us give more kids a better education, and a better chance. Email us at promise@us.oracle.com or visit www.oracle.com/promise

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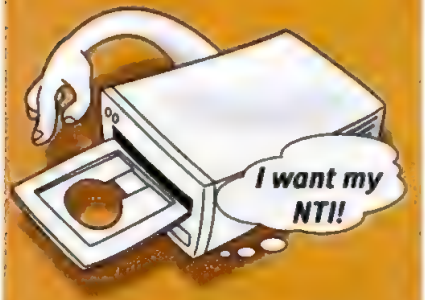

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	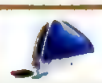	**Apple iMac** Blueberry M7440LL/A 333MHz PowerPC processor, 32MB RAM (256MB max), 6.0GB HD, K56flex V.90 modem, 24x-max variable-speed CD-ROM, Mac OS 8.5, 15" display (13.8" viewable)	$1199 $39.97/mo.*
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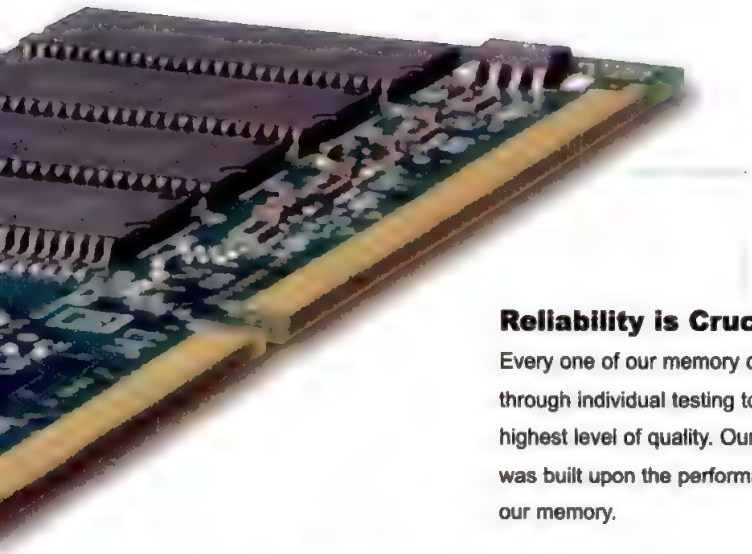

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LETTERS

GREAT SITE!

The review of Web page design tools ("Create a Great Site," June 8) is excellent, but it does not put nearly enough emphasis on which features require special server support. For example (speaking from FrontPage 98 experience), a lot of Microsoft's features don't work unless you have IIS and FrontPage support at the front end. In the future, when you review Web editing tools, it would be very helpful if you could include information about what to look for in a Web host for each of the tools.

For instance, I run a moderately large Web page but don't use FrontPage, because (among other reasons) it tends to generate code that is poorly written and sometimes incorrect, and it relies too much on Internet Explorer and Microsoft server-side software. As you point out elsewhere in this issue, Unix is still the server system of choice for the majority of Web hosts.

JOEL AMROMIN
via the Internet

There is some good information in this article, and some of the Editors' Choices make sense. I can see beginners to moderately experienced content providers using FrontPage 2000 as their design tool, but to name Windows NT and IIS as the preferred platform to serve Web sites is interesting, to say the least. I think a better approach to this article would have been to have thought of the business problems that your readers are trying to solve.

In doing this analysis, a requirements matrix could have been developed, with such things as the size of the site, expected hit counts, back-end database requirements, security requirements, search engine requirements, experience level of content providers and Webmasters, e-commerce components, and site owners' commitments to Java, Corba, and so on. The article then would have been applicable to a much broader audience. You completely ignored the mid- to upper-end site requirements. Given these, you might have reviewed tools from such vendors as Vignette, Interwoven, IntraDoc!, and others.

ED ARMSTRONG
via the Internet

Re your article about Web sites, and specifically about servers on which to host them: I was not very surprised about the poor Linux results. Recently, Linux has been getting far too much attention from the media. It's a beautiful desktop OS, but for servers—well, it just plain stinks. I have had great experience with another Unix-based operating system: FreeBSD (*www.freebsd.org*). Such major sites as Walnut Creek CD-ROM (*www.cdrom.com*) and Yahoo! (*www.yahoo.com*) run FreeBSD systems that handle far more data than any Windows NT–based system will ever see. And FreeBSD is incredibly easy to install.

YANN RAMIN
via the Internet

You should include information about what to look for in a Web host.

HEAD TO HEAD ON USB

In the June 8 issue, John C. Dvorak condemns USB ("Inside Track"), and a few pages later, Bill Howard praises USB ("Making the USB Connection"). How about doing a full PC Labs analysis of USB devices and telling us directly whether they really work as advertised?

TIM MAYNE
via the Internet

*In our February 23 issue, in the Solutions/Tutor section, we examined USB and tested by installing USB devices on platforms that supported them ("Making USB Work"). See that article for our conclusions (*www.zdnet.com/pcmag/pctech/content/18/04/tu1804.001.html*). We'll continue to review these devices as they become more prevalent.—Ed.*

NOT READY FOR WEB APPS

I am amazed that anyone from *PC Magazine* would say it's time for us to have our software on the Web and not on our own PCs (Jim Seymour's column "Web Apps: Yes, But ...," June 8). What company would be willing to trust having any corporate information stored on the Web, just waiting for a competitor to find it? And how many home users want to have to connect to the Web (and hope they don't get bumped off or fail to connect) every time they want to do some work at home?

I will not do my personal finances on the Web. Despite all the talk, it's just not safe enough yet. In fact, while I was typing this letter, I got cut off. I don't think that Seymour is in touch with most of the real world. Most people want to have control of what they do on their computers and not the other way around.

BOB BUNCH
via the Internet

GET IT TOGETHER

I would like to thank Jake Kirchner for his column "Getting Real About Getting Organized" (June 8). After spending a whole Friday doing IT firefighting and taking care of issues that weren't on my priority list on Thursday, I finally got to read your magazine. I was relieved to find that I wasn't rapidly going insane but was becoming a "knowledge worker" instead. Unfortunately, the euphoria did not last. Is it possible for a knowledge worker to go insane from all the stress and anxiety? Or is a little insanity a job requirement for knowledge workers of the 1990s?

Make it a rule to check your e-mail and messages at predetermined intervals and your ability to concentrate on the task at hand will improve. Keep your bosses and your subordinates well informed and the flow of requests to you will subside. Stop reacting to situations created by others' inability to manage their time and start creating situations that manage time. You will not go insane. And maybe you will remain a knowledge worker.

ANATOLI MANDELCHTAM
via the Internet

CELEBRITY TECHNOGEEK

In an Abort, Retry, Fail? item (June 8), a reader points out that in the violent Bruce Willis action flick *The Jackal*, the hero uses the Alt key "in combination with no other key." Any key on the keyboard sends a signal when pressed. Most programming languages let you trap for what key was pressed and then do something based on that key press. In Access 97 VBA, for example, I put a tiny piece of code in a form that basically says "Check for what key is pressed; if it is the Alt key by itself, then run Solitaire." And for years now, the Alt key, all by itself, in any Windows application, is used to activate the menu bar. How could *PC Magazine* call that "a computer first"?

T. GOULET
via the Internet

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*SAG & IBM two-way configurations. PC Computing, April 1999

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- Slots: (3)PCI (3)ISA (1 shared), (1) AGP, BX Chipset
- Integrated: PCI Soundblaster, 8MB nvidia Video
- 8GB IDE Hard Drive
- Sony 32X CD-ROM/Max
- Keyboard Floppy Mouse
- Intel Landesk Management Software
- Desktop Chassis

710

SAMPLE SERVERS

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- Slots: (7) PCI, (1) ISA • Integrated [illegible]
- Integrated Dual Ultra 2 LVD SCSI Controllers
- 4 Chan. Ultra 2 64 Bit RAID w/64MB Cache
- NEW! (3) IBM 36GB 10,000RPM LVD HD
- Intel Server Adaptor
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- 9 Drive Bay Q (6) 230 Watt Redundant Power Supplies

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- Integrated 10/100 Ethernet
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- 128MB ECC Memory Expandable to 1GB
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- Integrated Adaptec Ultra2 LVD SCSI
- Integrated 10/100 Ethernet
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- Power Supply Status
- Cooling Fan Status
- Visual and Audible Alarm

Q: (3) 36GB 7200RPM LVD HD 8825

Q: (3) 18GB 10,000RPM .5 Ovrs. LVD HD 7928

Q: (3) 9GB 10,000RPM .5 Ovrs. LVD HD 6458

STC 20 BAY

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- Q - (2) 4 Channel RAID 5 U/W Controllers
- B - 230 Watt Hot Redundant Power Supplies
- 128MB of Cache

Internal Temperature Status

- Power Supply Status
- Cooling Fan Status
- Visual and Audible Alarm

72GB Solution

Q: (8) 9.1GB 7200RPM LVD HD 18,750

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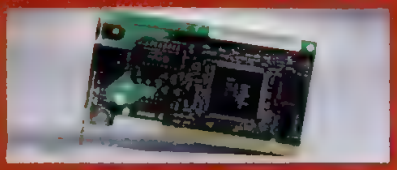

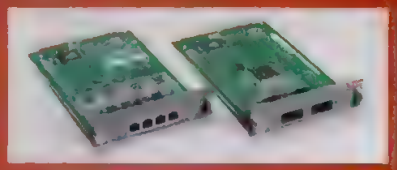

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LETTERS

GOOD GUIDs

John C. Dvorak's column is the first place I turn once my copy of *PC Magazine* has found its way across the Atlantic. I was rather amused to see that Dvorak has been taken in by the GUID (Globally Unique Identifier) hoax that has affected several commentators recently ("Inside Track," May 4). Those of us who have been developing or writing about the Component Object Model (COM) over the past five years have come to understand and love GUIDs. For a start, they are not Microsoft's, because GUIDs are basically the same as the Open Group's DCE universally unique UUIDs. Their purpose is far from sinister; they are unique 128-bit integers that are the "names" given to COM objects, interfaces, and applications to solve the problems of versioning that has plagued Windows.

Dvorak says that if a GUID from your machine was passed to a Web site, it would identify your machine, because it contains your network card's MAC address. It's true that the MAC address is used in a GUID to make sure that a GUID truly is unique, but there are two flaws in the argument: Not everyone has a network card in his machine, and in this situation the GUID generator uses a random number instead, so that any sinister Web site trying to track MAC addresses would get bogus values instead. But this is irrelevant anyway, because whenever you use the Internet, your IP address is sent with every packet—so your identity is already sent out across the Internet. Memo to Dvorak: Despite this momentary lapse into paranoia, I will still be an avid reader of your column!

RICHARD T. GRIMES
via the Internet

LONG LIVE FILM

Dvorak wrote a nice, provocative title ("Film Is Dead," June 8), but let's look at this issue from another angle. As a photo store and lab owner, I am very excited about digital photography, and we sell a lot of digital cameras. I am not one of these frustrated lab owners who think that digital cameras will take business away. There is a great opportunity here for photo stores to get with the program and start selling digital cameras. I agree 100 percent that Olympus has great cameras and lenses that produce (slightly) better pictures than Kodak's easier-to-use models. We also sell the Nikon 950, a work of art. But most of what we sell is to industry (auto body shops, insurance companies, dentists, contractors, engineers, and so on).

Most of these people don't print pictures: They e-mail reports to their customers. Prints are too expensive (and too slow) to output on an ink jet printer, and the cost is high—at least 60 to 90 cents a page (photo quality). This is why conventional photography is alive and doing well with consumers. Imagine a hundred 4- by 6-inch pictures of Europe. They would take at least an afternoon to print, versus 1 hour in our labs.

Here's the good news for digital camera users: Fuji, Konica, and other manufacturers are coming out with hybrid machines that can print at decent speeds from any media on inexpensive photo paper. When the industry offers this service, consumers will jump in and film sales will be affected—but not dead.

PAUL CLAIRMONT
Saint-Jean, Quebec, Canada

THE FINAL WORD

Regarding "IE5: The Final Cut" (First Looks, April 20): One aspect that isn't recognized in your review is IE5's lack of a print preview function. How many times have you accessed a long Web page and tried to print content that appears at the bottom or middle of the page? With print preview, you don't need to waste reams of paper to get the desired information. I support PCs that are installed in a public library, and users are always surprised to discover that a particular print job is in excess of, say, 30 pages. Once they learn to use the print preview feature in Netscape, they usually print only what they need. I really would love to know why Microsoft does not include print preview in IE5. Maybe if you cover this point in the future, the company will listen and learn.

ROCCO CASSANO
East Meadow, New York

WHAT'S IN STORE?

Because of the widespread use of scanners and mass storage devices such as huge-capacity hard disks, CD-Rs and CD-RWs, and others, and because of their decreasing prices, people like me are using them more and more to store and handle documents, photos, and so on. As a long-time subscriber to your magazine, I am suggesting an updated article focusing on this subject, evaluating and comparing the best available software for document management. This is a must, even for home computing.

ALBERTO FLORES
Brazil

Corrections and Amplifications

In our cover story "Future Technology" (June 22), in the section titled "Moore's Law Will Continue to Drive Computing" (page 146), we mistakenly wrote that "AMD's CTO, Atiq Raza, predicts AMD's new chips will be in copper by the second quarter of 1999." Raza actually predicted that AMD's new chips would be in copper by the second quarter of 2000. In the same story, we incorrectly referred to Active Worlds as Active Words; the correct URL is *www.activeworlds.com*.

In Bill Howard's column "Making the USB Connection" (June 8), we printed the wrong URL for the Universal Serial Bus Web site. The correct URL is *www.usb.org*.

In our story "Network Printers" (June 8), we stated that the Toshiba DP2480 digital copier does not have a duplexing option, when it fact it does. And the unit does not have a scanning option, as we stated it does.

In our story "Color Network Printers" (May 25), we incorrectly stated the average cost per page for the HP 2500Cxi on our Summary of Features table (page 184). For this printer, printing one page with 5 percent black coverage costs an average of 2.5 cents; a page with 25 percent color coverage costs 10 cents.

MORE TIPS FOR THE VISUALLY IMPAIRED

Regarding "PC Help for the Visually Impaired" in the Letters column (March 9), I would like to add a few helpful hints. First, a helpful information resource for anyone with impaired vision is the National Federation of the Blind's Web site at *www.nfb.org*. Here you can find references and links to many types of software, hardware, and non-computer-related assistance to the visually impaired.

In addition to the software you mentioned, there is a wonderful screen-reader program by Henter-Joyce: JAWS for Windows. JAWS allows a user to screen-read most available popular software, including word processing, spreadsheet, database, and e-mail programs. Also, its software synthesizer echoes a user's keystrokes for full two-way communication with the computer. A demo version of JAWS for Windows and a freeware version of JAWS for DOS are available at *www.hj.com*.

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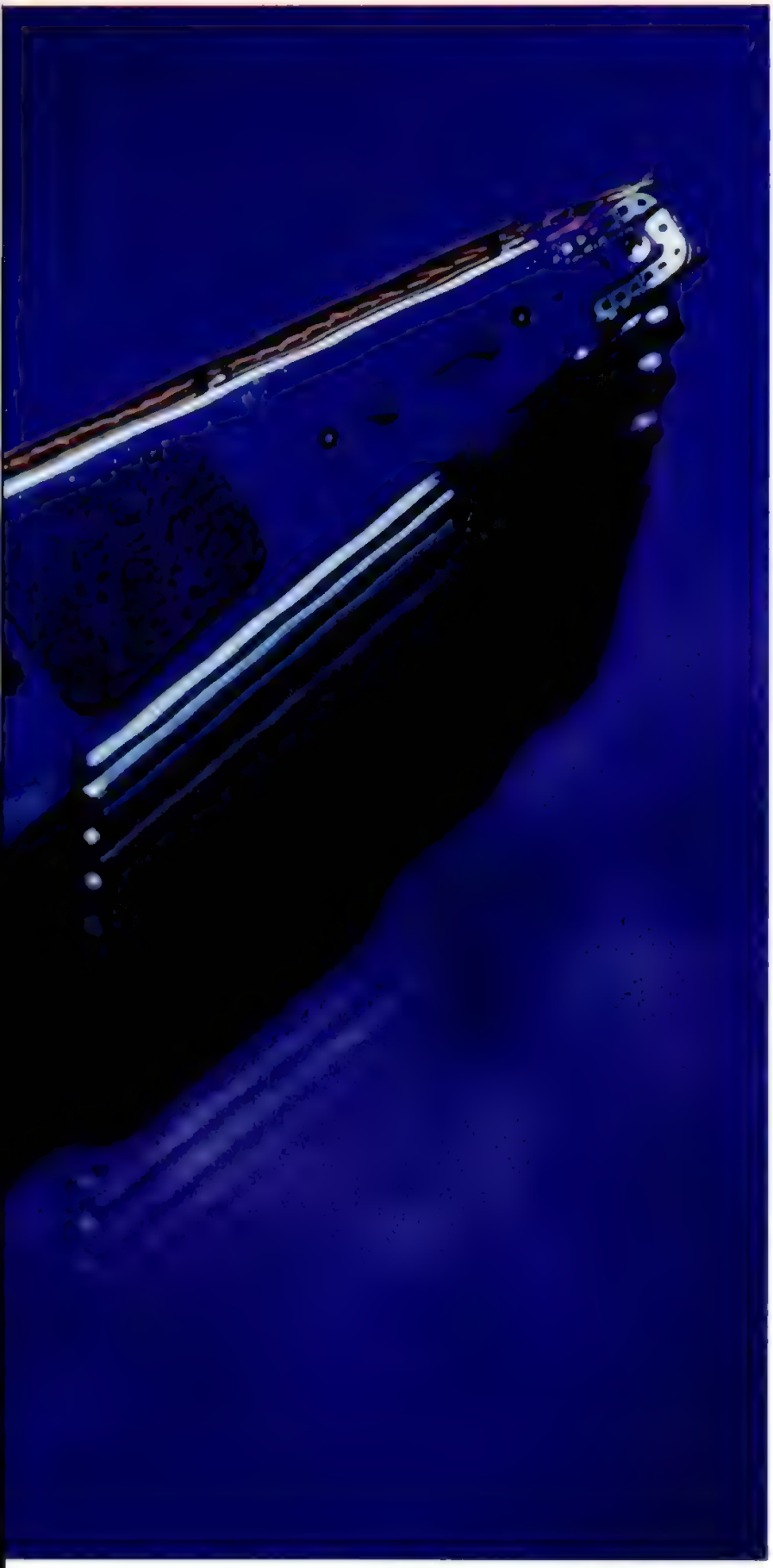

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21st-Century Gaming

From modems to cutting-edge chips, next-generation game consoles will advance to the next level.

A series of advanced gaming consoles is scheduled to arrive in the coming months from the power troika of gaming hardware: Nintendo, Sega, and Sony. But unlike the gaming consoles of previous generations, these new ones incorporate many technologies one might expect in a PC—a sure signal of convergence between gaming platforms and PCs.

One of the most hotly awaited next-generation gaming consoles is the Sega Dreamcast. After selling well in Japan, the Dreamcast is slated to ship in the U.S. on September 9 for $199. Each Dreamcast unit will have a built-in 56K modem; Sega is positioning the Dreamcast as the first network-ready gaming unit. Dreamcast currently features a 200-MHz SH4 RISC processor and a graphics engine built around the NEC PowerVR2 chip.

"This is the first console designed from day one with network capabilities," says Bernard Stolar, president of Sega of America, who notes that shipping the Dreamcast with a modem will introduce many current gamers to multiplayer online gaming. Market researchers at the Interactive Digital Software Association expect there will be 26.8 million online game players by the year 2002, with many of those gamers seeking multiplayer experiences.

Dreamcast isn't the only console that will ship with a modem. The upcoming version of the Sony PlayStation console—set to arrive next year—will also have a modem, in addition to a DVD-ROM drive, Dolby Digital and DTS sound, 32MB of memory, IEEE 1394 (FireWire), USB, and more. If you think that kind of package sounds a lot like a PC, you're not the only one.

The Sony PlayStation console will feature a new multimedia chip set that was custom-designed by Sony and Toshiba. The central CPU, called the Emotion Engine, is a cutting-edge chip based on a 0.25-micron fabrication process.

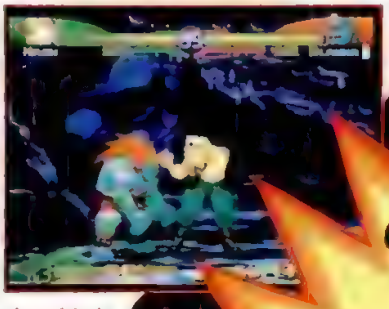
The Emotion Engine will be accompanied by an advanced graphics-rendering chip. The cost of the chips in the new console is expected to be near the price of the console itself, signaling a new business model for gaming consoles, where profits may be sought more from selling applications than selling consoles. At the recent Embedded Processor Forum, Sony drew raves for the graphics that the Emotion Engine produced.

Nintendo isn't surrendering the gaming battle to Sega and Sony, however. The company recently announced a multiyear, $1 billion technology agreement with IBM to cooperate on its next home video game console, code named the Nintendo Dolphin. IBM will equip the Dolphin with a 400-MHz processor, dubbed the IBM Gekko, based on 0.18-micron copper semiconductor technology.

The Gekko chip is an extension of IBM's PowerPC chip architecture, and the copper processor will be paired with an advanced graphics chip designed by a small California company called ArtX. Nintendo foresees the Dolphin console shipping in time for the year 2000 holiday season.

The Dolphin console should be capable of far better graphics than previously seen from Nintendo. "The lineup of talent working on this next system is hugely exciting," says Wei Yen, chairman of ArtX.

As technologies for gaming consoles become more and more PC-like, with modems, USB ports, and advanced chip technologies, many analysts say that the line between a PC and a gaming console is blurring significantly. Game technologies have always helped put PC technologies—such as advanced graphics and audio—on the fast track, and the next-generation gaming consoles promise both to borrow from the world of PCs and possibly to extend the PC platform.—*Sebastian Rupley*



Coming soon:

Sega Dreamcast
Fall 1999
With a built-in 56K modem, the Sega Dreamcast is slated to be the first network-ready game console

Sony PlayStation
Summer 2000
Combining a modem, a DVD-ROM drive, an IEEE 1394 connection, 32MB of RAM, and a Sony Emotion Engine CPU, the upcoming PlayStation may blur the line between PCs and game consoles

Nintendo Dolphin
Fall 1999
With a 400-MHz Gekko processor based on IBM's PowerPC, the Nintendo Dolphin is designed to serve up state-of-the-art graphics

More Trends Online • Experiments in self-configuring networks • Kodak's hybrid CD combines read-only and recordable technologies • Web-ready microprocessors • Plus: Expanded versions of the stories in this section

Faster Wireless Networks

Wireless LAN connections seem like the answer to IS managers' prayers. Wireless LAN cards inserted in PCs and portable computers eliminate the need for expensive network wiring and let employees stay connected while wandering a building or campus.

The popularity of PDAs with PC Card slots has put emphasis on wireless LAN connectivity. Who wouldn't want a hand-held connection to the corporate network from anywhere? But lofty goals often get muddled in corporate realities. Now 3Com says it wants to clean up wireless LANs and make them interoperable.

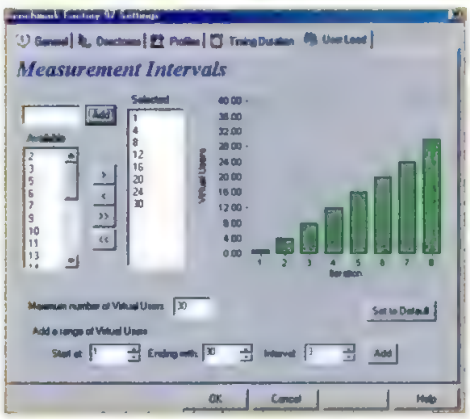
IS managers looking at the current crop of wireless LAN products consider proprietary technology and premium prices danger signs. For example, Lucent sought to lead this market with its WaveLAN product line, but the company didn't push for a robust technical standard and faces much more competition now than it did before. IEEE 802.11 was hailed as a meaningful standard but has served as a weak common denominator, with just 2-Mbps signaling. Companies such as Aironet, BreezeCOM, Proxim, and RadioLAN offer faster proprietary options.

3Com's rollout of its AirConnect product line consists of an access point, desktop adapters, and PC Cards that conform to an emerging standard called 802.11 HS. The HS standard provides for 11-Mbps signaling, so radio throughput will rival copper-cable connections. Before the end of the year, 3Com expects competition in the HS-compliant market. This time, 3Com says it intends to push the industry into interoperability testing. Early 2000 could prove the time to throw away copper-cable connections and reach for fast wireless products, but a powerful standard has yet to arrive.—*Frank J. Derfler, Jr.*

The Test That Wasn't

Sometimes, even with the most careful planning, discussion, and agreements, testing in PC Magazine Labs doesn't happen the way we expect. In addition to our thorough analysis of the features and capabilities of the databases in this issue's SQL-server roundup, PC Magazine Labs had hoped to break through vendor politics to provide you with an in-depth analysis of each product's performance. Given appropriate hardware, all of the databases in our roundup will be suitably fast for most applications. But there will always be applications that need all the speed they can get.

We planned to do something that has not been done in recent history: a comparison of database performance on the exact same hardware. Because a database software license prohibits publishing benchmark test results without the vendor's written permission, negotiating for permission is always a challenge. But after sending our specifications to vendors and engaging in weeks of discussion, we had written permission from Microsoft and verbal consent from Oracle—the two vendors with shipping products in our roundup.



PC Magazine Labs' benchmark testing framework, Benchmark Factory, lets us set up virtual users and gather performance statistics for any user load across any number of machines.

We invited technical representatives from each vendor into PC Magazine Labs to assist in tuning their respective databases to peak performance. This is a similar experience to that you might have if you bought a database and service from any of these vendors.

Our benchmark program was designed to run the gamut of applications for which you might use one of these servers. It consisted of a set of 50 SQL queries or programs (all of which we implemented as stored procedures) grouped into eight separate tests. Two tests focused on online transaction processing such as entering orders, two tests focused on running reports, and one each focused on ad hoc query processing (such as sales analysis or forecasting, backup speed, data load, and indexing) and generating statistics.

But just one week before Oracle was scheduled to come to the Labs to assist with our tests of Oracle8i, the company formally declined to let us publish any benchmark test results, stating that it was "not Oracle's policy to run arbitrary third-party benchmark tests." The company then said it wanted to focus its efforts on packaged enterprise resource planning (ERP) application benchmark tests such as those from Baan, PeopleSoft, and SAP and on tests from the Transaction Processing Performance Council (TPC).

The TPC-C is a valid benchmark test that shows cost per transaction based on the number of transactions and the cost of software, of hardware, and of three years' maintenance of the total system. But our careful review of TPC's Web site (*www.tpc.org*) revealed no true apples-to-apples comparisons. As we went to press, there was not a single TPC-C result for either Oracle8 or Oracle8i on any machine or cluster with fewer than 12 CPUs; total hardware and software costs for Oracle's test systems ranged from $1.6 million to nearly $16 million.

These are trophy numbers, tests where no expense is spared to get top figures. But the results do almost nothing to help you (or PC Magazine Labs) know how Oracle is going to run on the hardware you actually have. We wanted to use a benchmark program more suited for small and medium-size businesses.

If performance is important to your database application, we strongly encourage you to run your own tests to help you choose the most suitable product. To assist you, we've posted our complete specification online at *cgi.zdnet.com/slink?3220*.—*Jay Munro and Timothy Dyck*

ILLUSTRATION BY SIMONE TIEBER

DIGITAL CAMERAS/CELL PHONES

Person-to-Person Calling

Just as you're getting used to the transition from analog to digital cell phones, get ready for an onslaught of next-generation multifunction phones. These digital devices will incorporate everything from built-in pagers to PDAs, from fax and Internet connections to answering-machine functions and voice recording. And they'll be digital cameras too.

Most analysts agree that the convergence of digital cameras and cell phones is inevitable. The new devices will be instantly indispensable for Caller ID, visually displaying context or location, showing a product, capturing a printed document that can be converted into text, or shooting and saving photos of family and friends. Eventually, camera phones will also allow real-time videoconferencing.

Several major wireless manufacturers are developing camera phones or similar hybrids that take and transmit still images, but the first-generation products may offer limited functionality and won't be available anytime soon to the American market.

The Kyocera VP-210 VisualPhone

The designs vary considerably, but the basic unit will incorporate a lens, CMOS or CCD sensor, internal or removable memory, and a 1.8-inch or 2-inch TFT LCD screen. The camera and viewer will either be built into the handset or available as a detachable unit. For the sake of speed, picture quality will initially be limited to sub-VGA resolution and storage capacity of 10 to 20 images.

The Nokia 9110 Communicator, available only in Europe, looks more like a palm-size Windows CE device than a phone. Instead of a built-in camera, it's equipped with an infrared port for communicating with Casio and JVC digital cameras. the Motorola La Poche is also a two-piece unit, jointly developed by several companies for the Japanese market only.

Kyocera touts its silver VP-210 VisualPhone (sold only in Japan) as the world's first portable videophone that transmits and receives in real-time. As promised, it can conduct real-time conversations, albeit at the poky rate of 2 frames per second. The Kenwood Visual Communicator VC-H1 has a detachable camera head that swivels 360 degrees, but the device interfaces not with a cell phone but with an amateur-radio transceiver. Although manufacturers have not yet announced prices for camera phones, they're expected to sell between $400 and $800.—*Daniel Grotta and Sally Wiener Grotta*

The Web's Hip-Hop Future

Jake Kirchner

The Internet is barely out of the infant stage, and it already has a mature feel to it. Today's Web culture is made up of large, established communities: fanatic kitsch collectors living for eBay auctions, profit-crazed day traders hooked on Schwab.com, lonely-heart chat addicts marooned at America Online, book lovers communing at Amazon.com, credit card–carrying porn seekers, and more.

Although they are many and varied, these communities share one trait: They're overwhelmingly adult-oriented. At this point, we don't think of the Internet as an extension of the otherwise pervasive youth culture. But that's changing, and in a hurry. Teens and kids are the two fastest-growing groups of Internet users.

According to statistics from Jupiter Communications, there were approximately 8.6 million kids (5- to 12-year-olds) and 8.4 million teenagers (13- to 18-year-olds) online in 1998. By 2002, those cyberpopulations will increase to 21.9 million kids (a 155 percent increase) and 16.6 million teens (almost a 100 percent increase).

Only in the crazy world of the Internet could the Web be getting younger at the same time it grows older. Chat rooms, particularly AOL's, are enormously popular hangouts for the young cyberpopulation. And to hear the recording industry tell it, most young users are flocking to the Web to download pirated MP3 versions of their favorite bands. The phenomenon is much more complex than that, but there's no doubt this surge in youthful Internet users will have a profound effect on Web culture.

In e-commerce alone, the result will be huge. Jupiter predicts that teens will spend $1.2 billion online in 2002, and kids will spend another $100 million. Look for an accompanying large increase in the number of sites devoted to extracting those dollars from our children's pockets.

Just as young users will change the Internet, so too will the Internet affect younger generations. One example: A new MIT-sponsored survey found that 56 percent of high-school students said they would like to have careers involving the Internet or computing (*http://web.mit.edu/invent*). In case you're wondering, only 28 percent said they hope to become doctors, 20 percent said they're looking to careers in journalism or the law, and 16 percent want to be stockbrokers. Even more impressive was the finding that 71 percent of the parents of high-school students would want technology careers for their children.

And perhaps we already have enough doctors, lawyers, journalists, and stockbrokers. But this trend is sure to raise serious concerns in the fields of education and the law. If half of our children want to develop careers in the Internet and computing, our high schools and colleges must alter their curricula drastically. And you can bet the government is going to be much more active in overseeing Internet content and commerce directed at minors.

Today's teenagers have grown up with the Web. In growing numbers, they use it for information, e-mail, and commerce. For most of them, it's just a tool. They don't think of it as a cool place to hang out, which explains why the Web is thankfully free of the hip-hop sensibility that marks much of America today. Once the kids and teens start spending significant amounts of money online, however, that will all change, and the Internet will shine through a much more youth-oriented veneer, for better or worse.

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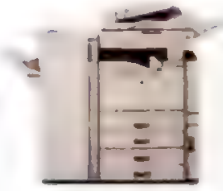

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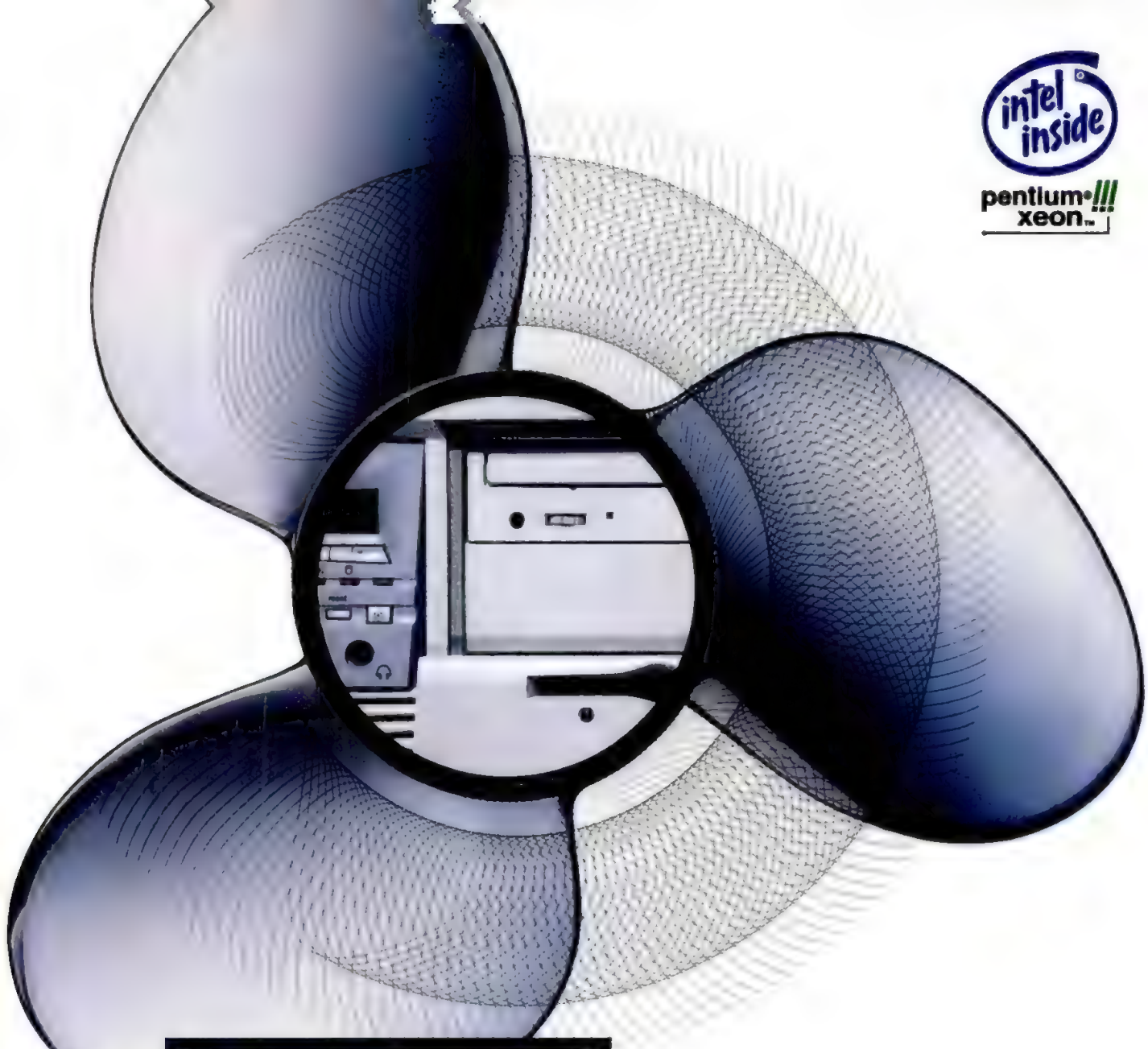

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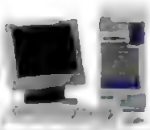
64 MB ECC SDRAM
4.3 GB UATA HD
Matrox® Millennium G200 graphics card
32x CD-ROM
Windows NT® 4.0
TopTools manageability:
DMI 2.0 compliant
MaxiLife H/W monitoring and LCD panel
ConfigTailor for S/W deployment and recovery
Y2K compliant
3-year worldwide warranty
D6723T

$1,457*

Affordability (some powerful stuff).



Kayak XA-s
Desktop—Dual-Processor Capable
Pentium II Processor
400 MHz
64 MB ECC SDRAM
4.3 GB UATA HD
Matrox Millennium G200 graphics card
32x CD-ROM
Windows NT 4.0
TopTools manageability:
DMI 2.0 compliant
MaxiLife H/W monitoring and LCD panel
ConfigTailor for S/W deployment and recovery
Y2K compliant
3-year worldwide warranty
D7986T

$1,760*

Kayak XA-s
Minitower—Dual-Processor Capable
Pentium III Processor
500 MHz
128 MB ECC SDRAM
9.1 GB UW SCSI HD
ELSA GLoria Synergy+ graphics card
32x CD-ROM
Windows NT 4.0
HP 10/100 PCI NIC
TopTools manageability:
DMI 2.0 compliant
MaxiLife H/W monitoring and LCD panel
ConfigTailor for S/W deployment and recovery
Y2K compliant
3-year worldwide warranty
D7984T

$2,684*

Kayak XA-s
Desktop—Dual-Processor Capable
Pentium III Processor
550 MHz
128 MB ECC SDRAM
9.1 GB UW SCSI HD
Evans & Sutherland AccelGALAXY graphics card
32x CD-ROM
Windows NT 4.0
HP 10/100 PCI NIC
TopTools manageability:
DMI 2.0 compliant
MaxiLife H/W monitoring and LCD panel
ConfigTailor for S/W deployment and recovery
Y2K compliant
3-year worldwide warranty
D7989T

$4,097*

Dual processing (faster, faster).

Kayak XU
Dual-Processor/RAID Capable
Pentium III Processor
550 MHz
128 MB ECC SDRAM
9.1 GB UW SCSI HD
Matrox Millennium G200 graphics card
32x CD-ROM
Windows NT 4.0
HP 10/100 PCI NIC
Dual SCSI controllers
TopTools manageability:
DMI 2.0 compliant
MaxiLife H/W monitoring and LCD panel
ConfigTailor for S/W deployment and recovery
Y2K compliant
3-year worldwide warranty
D8920T

$3,454*

Kayak XU
Dual-Processor/RAID Capable
Pentium III Xeon™ Processor
550 MHz
128 MB ECC SDRAM
9.1 GB UW SCSI HD
ELSA GLoria Synergy+ graphics card
32x CD-ROM
Windows NT 4.0
HP 10/100 PCI NIC
Dual SCSI controllers
TopTools manageability:
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MaxiLife H/W monitoring and LCD panel
ConfigTailor for S/W deployment and recovery
Y2K compliant
3-year worldwide warranty
D6345T

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HARDWARE

Thin Servers Fan Out

The concept of thin servers—appliance-like servers stripped of extras and including only what's needed to perform simple, dedicated tasks—is beginning to take hold. A wave of thin servers is expected to hit the market by the end of this year, with several appearing already. Increasingly, it's looking like thin servers will take many different shapes.

Among the companies diving into the thin server market are Compaq, with its TaskSmart machines; IBM, with a new line of single-purpose Unix servers; Intel; Microsoft, with easily administered software designed for home and small-business servers; Oracle, with its Raw Iron dedicated database server systems; Sun Microsystems, with systems dubbed Flapjack servers; and a host of other companies, including Auspex, Cobalt Networks, and Encanto Networks. According to research analysts at Merrill Lynch, sales of thin servers are expected to increase from 1997 sales of $1.1 billion to $16 billion by 2002.

The machines, arriving between now and the end of this year, target several markets. IBM is set to ship a new line of inexpensive, single-purpose Unix servers, code named Pizzazz, by September. The machines will be stripped of everything except what they need to perform specific tasks, such as securing networks or serving Web pages. Compaq is pursuing the same kinds of enterprise-focused goals with its new TaskSmart line, as is Sun with its Flapjack servers.

The Compaq TaskSmart machines are due to arrive in July and will sell for less than $10,000. The first systems will be based on 450-MHz Pentium chips and designed for specific tasks such as caching Web pages, serving e-mail, and hosting databases.

Microsoft is forecasting a healthy market for Windows Server Appliances aimed at homes and small businesses, which company president Steve Ballmer says will ship in volume by the end of this year. At the recent Windows Hardware Engineering Conference (WinHEC), Ballmer demonstrated one of the simple servers running a Configuration Wizard utility from Microsoft. This feature was able to automatically set up a network printer, a shared Internet connection, and file sharing.

"There are a lot of folks out there who want to buy an inexpensive server for file sharing, printer sharing, and sharing an Internet connection, who don't want to hassle with configuring and maintaining a server," Ballmer said. Windows Server Appliances will cost less than $2,000, according to Ballmer, and the devices will forgo complicated administration and security features in favor of ease of use.

Oracle is also increasingly interested in the idea of dedicated servers stripped of everything except what they need to perform specific tasks. Through the company's Raw Iron partnership with Dell Computer, Hewlett-Packard, and Sun Microsystems, Oracle CEO Larry Ellison foresees an ongoing market for servers that run Oracle 8i without the need for other operating systems, such as Microsoft Windows NT. (Oracle 8i incorporates many operating system–like features—such as a complete file system—in addition to database functionality.)

"If the only thing you're running on the server is Oracle 8i," says Ellison, "you don't need much of an operating system. You certainly don't need an operating system like Windows NT or any other full-blown complex OS."

—Sebastian Rupley

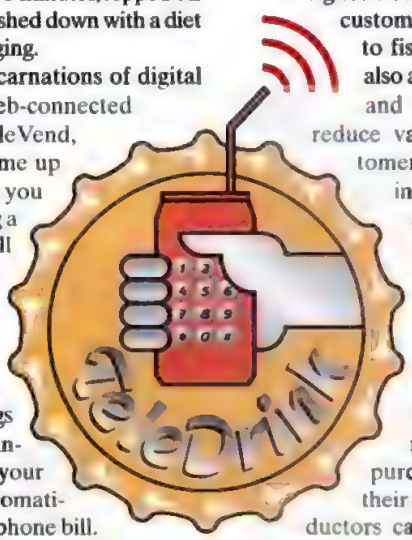
ILLUSTRATION BY FRANKLIN HAMMOND

E-COMMERCE

Care for a Teledrink?

You can be quite confident that your interaction with the office vending machine is anonymous. It doesn't know you're the one who purchased three bags of chips in a span of 5 minutes, topped off with a candy bar and washed down with a diet soda. That may be changing.

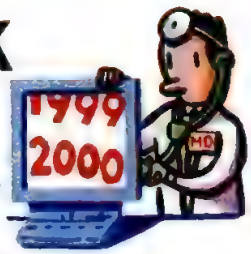
One of the latest incarnations of digital convergence is the Web-connected vending machine. TeleVend, based in Israel, has come up with a system that lets you purchase items by using a cellular phone to call the number listed on certain, specially equipped vending machines. The back-end system then processes the transaction and rings the vending machine, instructing it to dispense your order. The payment automatically shows up on your phone bill. And each time you connect to make a purchase, you're encouraged to supply data about yourself in exchange for discounts. The machines are equipped with coupon-dispensers as well.



The newfangled vending machines are designed not only as a convenience for customers—who no longer need to fish for loose change—but also as a way to track inventory and malfunctions remotely, reduce vandalism, and grab customer attention with advertising. Equipped with speakers and displays, the machines can play audio and video advertising during transactions.

TeleVend is also working with a Japanese company to adapt the system for Tokyo commuters, enabling them to purchase train tickets over their cellular phones. Train conductors carrying mobile TeleVend tracking units will be able to verify ticket purchases. *—Carol Levin*

Y2K Health Check



By Greg Alwang

Time is running out. Whether you're a business or individual user, it is no longer enough to simply form a plan of action about Y2K. You have to ensure that the plan is being executed right now. Among the hordes of Y2K Web sites, there are many that provide a wealth of information to assist you in learning about the Y2K problem. Whether you have to deal with legal fallout from Y2K or want your family to be prepared for the worst, you can get the lowdown on the Web. Most Y2K-related sites provide links to other Y2K resources, so you can generally find what you're looking for without too much trouble.

Prepare Your Business

Up to and even after the new millennium, businesses will be assessing and revisiting Y2K liability issues. Knowing your status as well as that of the partners, distributors, and major customers who influence your day-to-day operations can help you stay proactive about the Y2K problem. For a macro view of Y2K, check the **President's Council on Year 2000 Conversion** (*www.y2k.gov*) and the Small Business Administration's **Small Business Help for the Year 2000** (*www.sba.gov/y2k*). Both provide good overviews of Y2K, the status of various government agencies, and steps toward assessing your own business. You'll also find links to sites covering local government and regional business issues.

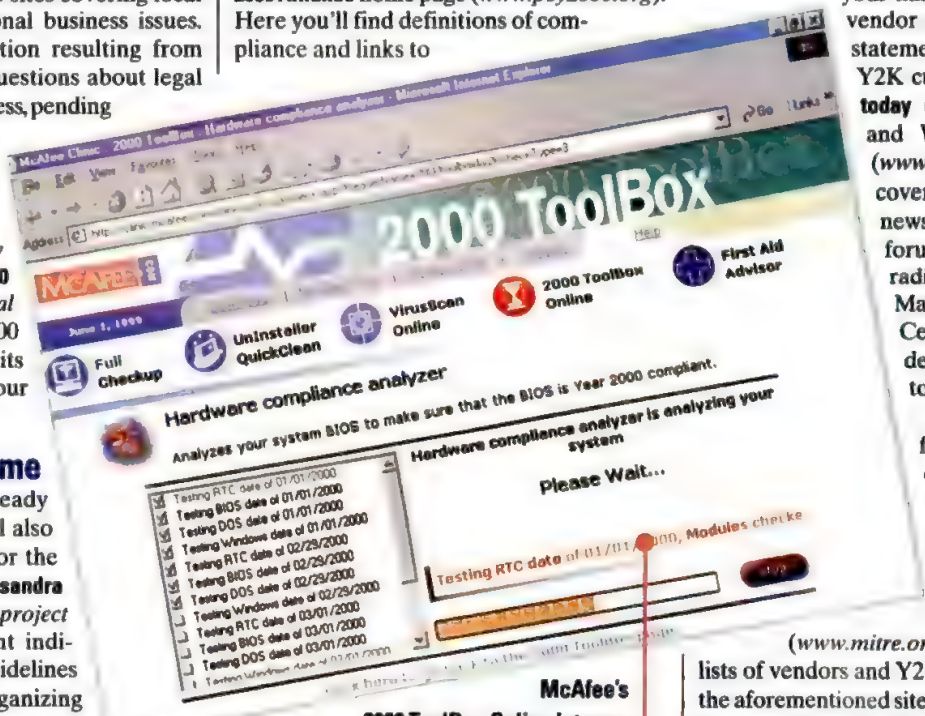
The potential litigation resulting from Y2K is hair-raising. Questions about legal liability and preparedness, pending cases, and legislation can be answered at **The Y2K Law Site** (*www.legal.y2k.com*), the site **Year 2000 Liability** (*www.2000law.com*), or **2000 Legal.Com** (*www.2000legal.com*). Visit the Year 2000 Liability site and take its online test to weigh your legal preparedness.

Protect Your Home

Aside from being ready for Y2K at work, you'll also want to be prepared for the effects at home. **The Cassandra Project** (*www.cassandraproject.org*) includes excellent individual-preparedness guidelines and information on organizing neighborhoods and communities—our best hope to spread awareness and avoid Y2K hysteria. The **American Red Cross** (*www.redcross.org/y2k.html*) has down-to-earth explanations of the potential effects of Y2K and how families can be prepared. **Y2K for Women** (*www.y2kwomen.com*) offers a nontechnical but practical perspective on dealing with Y2K. The site is ideal for any head of a household (not just women) who wants to learn about Y2K from the ground up.

Check Compliance

If your PCs and applications are Y2K compliant, you have a better shot at sailing through Y2K unscathed. To gain an understanding of Y2K compliance, visit the **PC Year 2000 Alliance** home page (*www.pcy2000.org*). Here you'll find definitions of compliance and links to Alliance member sites. There are hundreds of software tools for determining whether your hardware and software are Y2K compliant. Check the **PC Magazine Year 2000 Resource Center** (www.pcmag.com/special/y2k) or **CNET Y2K.com** (*www.y2k.com*) for links to Y2K product reviews and downloads. Two free utilities for checking and fixing your PC's hardware/BIOS compliance are **Viasoft's OnMark 2000 BIOS Test & Fix** (*www.on-mark.com*) and **Symantec's BIOS Test and Fix** (*www.symantec.com/sabu/n2000/fs_corporate.html*). A few tools even let you check compliance over the Web. The best online tool we've seen yet is **McAfee's 2000 ToolBox Online**, part of the McAfee Clinic (*www.mcafee.com/clinic/2000tb.asp*). The online version of 2000 ToolBox is free (you just have to register) and includes compliance analyzers for hardware, applications, databases, and spreadsheets.



McAfee's 2000 ToolBox Online lets you check the compliance of your hardware and software for free over the Web.

Seek Help

If you're behind the curve on Y2K, and you still want to assess your risk, fix date-sensitive programs, or test applications, or if you're just looking for some assistance dealing with Y2K, there are loads of sites covering general Y2K topics from current news to lists of Y2K consultancies. In addition to checking your hardware and software vendor sites for compliance statements, stay on top of Y2K current events at **y2ktoday** (*www.y2ktoday.com*) and **Y2K News Magazine** (*www.y2knews.com*), which cover breaking year 2000 news and offer discussion forums and daily talk-radio shows. The PC Magazine Y2K Resource Center also provides in-depth analysis of Y2K tools and issues.

A good source for technical details on compliance, solutions, contingency planning, and links to other resources is **The MITRE Corp.'s Year 2000 Homepage** (*www.mitre.org/research/y2k*). For lists of vendors and Y2K consultants, check the aforementioned sites, the **IT Association of America's Year 2000 Home Page** (*www.itaa.org/year2000*), or **The Year 2000 Information Center** (*www.year2000.com*). PC

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- 13.6GB Ultra ATA Hard Drive
- 40X Max[2] Variable CD-ROM
- SoundBlaster AudioPCI 64D
- GCS-200 Speakers by Cambridge SoundWorks
- 56K[3] Internet/Fax Modem
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EV700 .28 Screen Pitch 17" Monitor (15.9" viewable)	EV700 .28 Screen Pitch 17" Monitor (15.9" viewable)	VX900 .26 Screen Pitch 19" Monitor (18" viewable)	VX900 .26 Screen Pitch 19" Monitor (18" viewable)
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6X DVD-ROM Drive & MPEG2 Decoder	6X DVD-ROM Drive & MPEG2 Decoder	6X DVD-ROM Drive & MPEG2 Decoder	22GB **Ultra ATA 66 7200 RPM** Hard Drive
SoundBlaster® AudioPCI™ 64D	SoundBlaster AudioPCI 64D	SoundBlaster AudioPCI 64D	6X DVD-ROM Drive & MPEG2 Decoder
Boston Acoustics® BA735™ Digital Speakers w/ Subwoofer	**Boston Acoustics** BA735 Digital Speakers w/ Subwoofer	**Boston Acoustics** BA735 Digital Speakers w/ Subwoofer	**Philips® CD-RW (CD-Rewritable) Drive w/Media**
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Microsoft® Windows® 98	Microsoft Windows 98	Microsoft Windows 98	3Com U.S. Robotics 56K[3] PCI Voice Ready WinModem®
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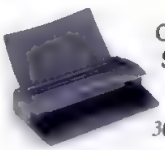

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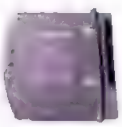

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Back It Up Online

How do you protect the mission-critical data that travels with your remote workers? We review four online backup applications.

TAKE IT WITH YOU: Toshiba continues to improve its line of ultra-mobile PCs with the Portégé 3110CT. *Page 53.*

SPEAK UP: L&H introduces a new version of its flagship product, L&H Voice Xpress Professional 4.0. *Page 60.*

IT'S A SNAP: The latest Meridian Data Snap! Server 2.0 adds flexibility and ease of use to network attached storage. *Page 76.*

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By Steve Rigney

Many mobile workers are playing Russian roulette with their data. Network administrators are more than aware of this problem, but they haven't found many solutions. Tape devices are too big and bulky to take on the road; dial-up connections are too slow for anything but e-mail. To make matters worse, nomadic workers may be carrying some of the most important data a corporation owns. And this data needs to be protected over dial-up connections in places such as airport terminals and hotel rooms.

A nomadic insurance policy is the goal of several products called *online backup applications*. They analyze your data, reduce its size, and send it to a centralized server whenever a remote user connects to the Internet or an intranet. Administrators can control what the user sends to the server and schedule the backup process so that a remote worker doesn't have to remember to perform a backup. All the products can work across a LAN as well.

Here we review four online backup products: Connected Corp.'s Connected Network Backup 4.0 (CNB), CoreData's RemoteWorx 3, Stac Software's Replica Network Data Manager 1.7 (Replica), and Veritas Software Corp.'s TeleBackup for Workgroups 2.5 (formerly Seagate Client Exec). CoreData and Stac submitted new and improved versions of their products; both CNB and TeleBackup were recently reviewed in Networking First Looks ("Back Up, Boot Up," March 23, and "Back Up With Ease," February 23, respectively.)

HOW THEY WORK

Online backup applications rely on two pieces of software: a *client agent* and a *storage server*. The client agent is a Windows-based utility that runs in the background on a remote PC. In addition to monitoring for changed files to backup, the agent also keeps the schedule for planned backups.

Some client agents, such as CNB's, can even watch for a connection and begin sending data whenever the remote client establishes a connection. The agents are also responsible for compressing and encrypting the data. (For more information on transfer and backup methods and on the terminology we use in this story, see the sidebar

ILLUSTRATION BY CARY HENRIE

Online Backup Techniques

What a mobile worker needs is a product designed to send data across slow connections. That's where online backup applications come in. They send the largest amount of data in the shortest time by sending only the data that has changed, compressing data, and sending data only when the remote worker connects to the host server.

Delta transfer is the term most of us use for an algorithm that examines a file to see what changes have been made since the last time it was accessed. All of the products we review here perform some type of delta transfer, even if they don't use that moniker. With the exception of RemoteWorx 3, all of the products in this roundup perform delta scans only at block level. This means that they send only the blocks of data that have changed within a particular file—not the entire file. RemoteWorx also works at byte level. Because there are 512 bytes in a block, byte-level file transfers are smaller. But scanning for changes at byte level takes more time than at block level, so RemoteWorx does this scan when the remote PC is not connected and saves the package for delivery during the next connection. All of these products offer some form of compression to shrink the data even more.

If you let remote users choose the data that will be protected, they will probably choose to protect every file, from games to spreadsheets. With client PCs containing several gigabytes of applications and data, this can really deplete the disk space on the server. Fortunately, most online storage products provide a feature called single-instance storage. For example, once the first user has backed up a directory, such as Windows NT, the server can detect the OS and prevent the same files from being stored twice. Only changes to existing files are stored. The same is true with applications and data. The administrator should choose a network PC that has loaded all applications used on the network. This lets backups run faster and limits network and remote traffic.

"Online Backup Techniques.")

The server software keeps track of all agents, stores and retrieves data, and keeps a common database of individual files. Note that the server software does not provide any other protection for the data. For further protection, you'll need to back up the data on removable media.

Even when remote workers have a central repository to hold their important data, they may not use it. For this reason, all of the products except Replica let you create jobs for mobile workers—that is, backup runs without user input. For example, administrators can decide which files to back up and which to ignore. They can also schedule the times for backups to run.

Which jobs are currently running, how much space is in use on the server, and which users are not performing backups are important questions for an administrator. Fortunately, all of the products here provide reports to answer most of these questions.

Whether you use an online backup service (see this story's Editors' Hot Links) or roll your own solution using one of the products here, you must protect your mobile data. A central repository for storing and retrieving information is more important than it ever has been.

Connected Network Backup 4.0

PC MAGAZINE EDITORS' CHOICE

Connected Corp. is the only vendor in this roundup that offers both an online backup service, Connected Online Backup (COB), and an online backup product, Connected Network Backup 4.0 (CNB), our Editors' Choice in this roundup. Both provide the same client capabilities; CNB also provides single-instance storage, delta transfers, and user monitoring. Some of CNB's unique features are Point-in-Time Repair, a browser interface for management, and a knowledge base that answers basic help-desk questions.

CNB retails for $6,000 (list) for the server software and $149 per client PC. The price drops to around $105 per client if you purchase a license for 500 clients or more. CNB is also available in a higher-end solution that includes built-in HSM (hierarchical storage management) and mirrored-server software. This is the only product to provide these optional features, but the loaded version will cost you around $20,000.

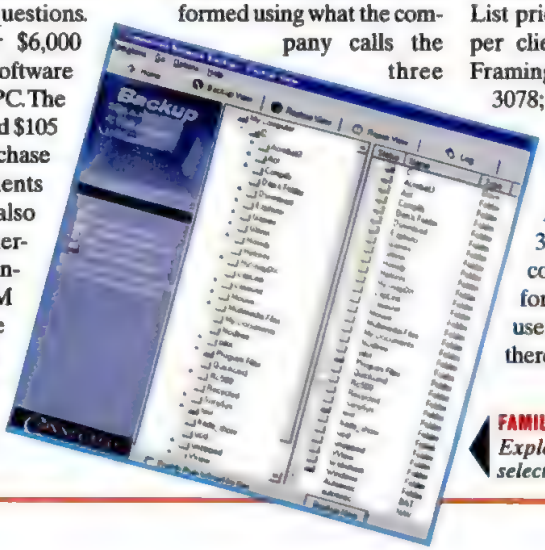
Management of CNB is performed using what the company calls the three "AOK" utilities (account manager, organization manager, and knowledge base). All of the utilities are accessed via a standard browser. Account manager lets you set up users and define which files can be stored and retrieved, and it provides reports on individuals. Organization manager provides reports on server usage by file and groups of users.

CNB's Point-in-Time Repair (PTR) resides on each client PC and takes a snapshot of all of the computer settings, including the registry, INI files, and other personal settings. If a client's hard disk crashes, you simply have to reinstall the OS and start the network connection, and the CNB agent will restore everything. This feature also works with applications.

For managing multiple servers and clients, we really liked CNB's browser-based utility. We were able to connect to a CNB server from any location to set up users, create backup jobs, and view reports. Unfortunately, you can view and manage only a single server at a time. TeleBackup also has a remote management utility, but it's a proprietary Windows utility and not an HTML application.

CNB is extremely well rounded, with the knowledge base, browser-based management, and PTR to guarantee you can recover from any crash.

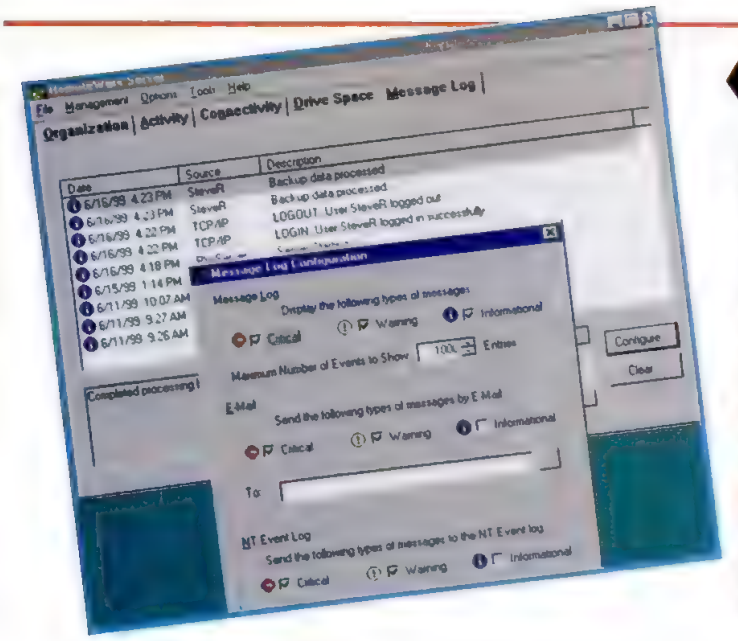
Connected Network Backup 4.0. List price: Server, $6,000; $149 per client. Connected Corp., Framingham, MA; 800-353-3078; *www.connected.com.*



FAMILIAR: *CNB provides an Explorer-type interface for selecting files to back up.*

RemoteWorx 3

Although RemoteWorx 3, from CoreData, is very configurable, it doesn't force the administrator to use its complex settings and therefore can be quite easy to



YOUR CHOICE: *The RemoteWorx server utility lets you view a log of server events and customize the icons to reflect any errors.*

use. Designed especially for mobile workers, RemoteWorx has the unique ability to prebuild backup packages when the user is not connected to the server, which saves time during the connection.

RemoteWorx is also the only product here to provide both byte- and block-level transfer options as well as a basic asset management utility. Some important features missing from RemoteWorx include a single-instance storage option, as well as the ability to limit the amount of disk space a client can use.

At $1,695 (list) for ten users, RemoteWorx is more expensive than TeleBackup but costs significantly less than CNB and Replica. Like the other solutions, the RemoteWorx package includes a Windows NT–based server repository and client software for Windows 95, 98, and NT. We found the product very easy to install, even though the manual is a little confusing.

RemoteWorx has more options for storing and retrieving data than any other product we review here. In addition to using a standard TCP/IP dial-up or LAN connection, users can also store data in a shared folder or dial directly into the server via a modem.

By default, RemoteWorx examines and transfers new data at byte level. Bytes of data are smaller than blocks, so the data transfers faster. There is a drawback to using this method, though: To provide faster transfers when you are connected, RemoteWorx keeps a copy of the backup package on the client PC's hard disk to avoid having to create a new one each time. Unfortunately, even with compression, that package could be up to 50 percent of the size of the data you back up.

One benefit of this method is that you can use the RemoteWorx client to recover lost data from this backup file if you can't connect to the server. RemoteWorx can also perform backups at block level.

Administrators have only two options for controlling backup packages in RemoteWorx: *protected* and *unprotected*. When you mark a single user or group of users as unprotected, they are able to pick which files they want to back up and when. If you protect a user or group, only the administrator will be able to pick files for storage and set the schedule.

RemoteWorx 3 earns an honorable mention for its flexible ability to transfer at both byte and block levels, as well as its ability to prebuild data for connection.

RemoteWorx 3. List price: For 10 users, $1,695. CoreData Inc., Phoenix; 602-437-6575; *www.coredata.com*.

Replica Network Data Manager 1.7

When Stac Software first introduced Replica Network Data Manager (Replica) a few years ago, it was sold to Fortune 100 corporations at a cost of around $100,000. Since that time, smaller businesses have seen the need for online backup solutions, and Stac has redesigned its product for these customers. In fact, Replica is probably the easiest product in this roundup to set up, for both the administrator and the user.

One of the reasons for this ease of use is Replica's integration with common Windows applications, such as Explorer, Microsoft Management Console (MMC), and the My Computer folder. Other commendable features of Replica are a SQL database for managing the storage vault on the server and a throttling (or *load-balancing*) feature for controlling the number of users accessing the server. The only features missing from the product are the ability to resume backup in the middle of a file if the connection is broken and the means for the administrator to control what is stored and when the user stores files on the server.

Although Replica is a little less expensive than CNB, the product is still $5,000 (list) for a single server and approximately $125 per client, in small quantities (higher volumes are discounted). With the inclusion of the SQL database, we expected the server installation to be much harder than it was. Although the installation is not as fast as those of RemoteWorx and TeleBackup, Replica includes a wizard that limits the number of questions you have to answer.

Likewise, the main installation utility lets you complete a no-input (or silent) install program for the client PCs. This means that you can send all of the Replica agent software to the client PCs, and users can install the program without answering any questions.

The administration utility is

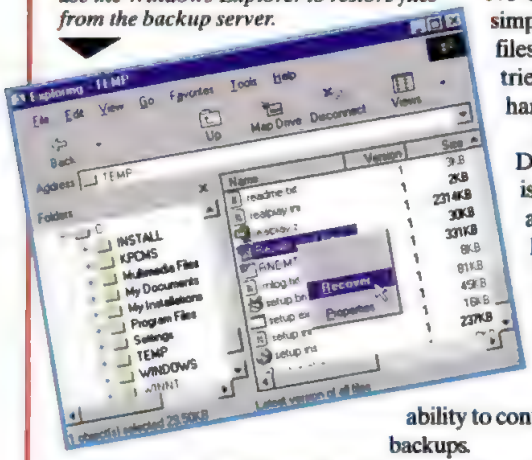
Editors' Choice

- Connected Network Backup 4.0

PC MAGAZINE EDITORS' CHOICE

Selecting an Editors' Choice from the four online backup products in this roundup was not an easy task. All of the products make it easy for remote and mobile workers to back up and restore their data from any location. We chose Connected Network Backup 4.0, from Connected Corp., because of its well-rounded features and enhanced capabilities. Features such as Point-in-Time Repair provide users with the tools they need to recover from any type of disaster quickly. Likewise, the browser management interface eases the task for administrators when they create jobs, set up users, and manage usage from a remote location. Strong security and flexible options round up the list of powerful features in the product.

But we couldn't overlook the excellent flexibility found in CoreData's RemoteWorx 3. The ability to use either byte- or block-level backups and prebuild data for transfer makes RemoteWorx an ideal tool for nomadic users who have to send a large amount of data in a short time. For this reason, we award RemoteWorx 3 an honorable mention.



ROAD TO RECOVERY: *Replica allows you to use the Windows Explorer to restore files from the backup server.*

straightforward and runs as an MMC snap-in. Replica lets you create either protected machines or protected users. You can select each target, then select files to be excluded from the backup sets and also provide a backup priority. Unfortunately, the administrator can't control when the backup takes place.

Like CNB and TeleBackup, Replica includes a single-instance repository that eliminates the need for the client to back up existing files. Replica also utilizes block-level delta transfers and shrinks the data before sending using Stac HLZS compression.

Our favorite feature of Replica's backup process is the ability to use the My Computer folder to initiate a transfer. You just select the folder to back up, right-click on the mouse, and choose the Replica option.

Restoring data is just as easy. For example, all backed-up files and their versions show up in the Explorer window on any Windows 95, 98, or NT client. Users can simply drag and drop files they want to retrieve to their local hard disks.

Replica Network Data Manager 1.7 is very easy to use, and we especially liked its integration with Windows programs. The program's biggest drawback is its inability to control the timing of backups.

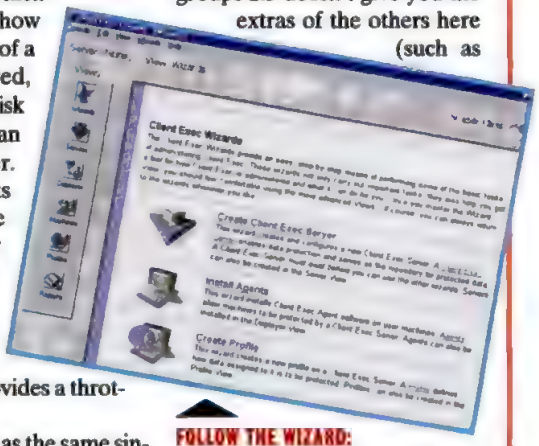
Replica Network Data Manager 1.7. List price: Server, $5,000; $125 per client. Stac Software Inc., San Diego; 800-522-7822; *www.stac.com.*

TeleBackup for Workgroups 2.5

TeleBackup is the name of a company and product recently acquired by Veritas Software Corp. Veritas also owns part of Seagate Software, which developed the Client Exec online-backup solution. For this review, we are actually looking at Client Exec, but based on the wishes of Veritas, we are calling it TeleBackup for Workgroups 2.5. With that said, TeleBackup is a low-cost solution that provides e-mail deployment, server throttling, flexible security, and excellent reporting.

At $7,600 (list) for 200 users, TeleBackup is the least expensive product in this roundup. This price includes the e-mail client-deployment tool, an option that costs about $2,000 in RemoteWorx. As with the other products, TeleBackup is easy to install and includes wizards to walk you through the process. The server runs on Windows NT, and the client will work with Windows 95, 98, or NT.

After we installed the server software, we were impressed with the security and flexibility available for creating users. We used the administration utility to set up user profiles before we deployed the software to each user. The profile includes a user name and password, which data to back up, how many revisions of a file can be stored, and how much disk space the data can use on the server. TeleBackup lets you either define all of this for users or give them some control. Like Replica, TeleBackup also provides a throttling feature.



FOLLOW THE WIZARD: *TeleBackup includes wizards for creating servers, clients, and user profiles.*

TeleBackup has the same single-instance repository as the other products in this roundup, with the exception of RemoteWorx. It also examines and sends files at block level, but not at byte level. In the event of a disconnect, TeleBackup can pick up the transfer at the nearest block of data from which it left off.

Similar to Replica, TeleBackup integrates with Windows Explorer to retrieve data. A new folder called My Backups appears on each client PC and lists all of the files and directories stored on the server and their version numbers. Users can simply select which files they want to restore and drag them back to their local desktops.

All of the products here provide monitoring and reporting information, but TeleBackup presents it in the easiest-to-use format. You can use TeleBackup to see total storage by user, machine, or group and to monitor backup and resort jobs in progress.

Though TeleBackup for Workgroups 2.5 doesn't give you the extras of the others here (such as PTR and byte-level data transfer), the price might be right for offices that just want basic backup and retrieval of files from remote locations.

TeleBackup for Workgroups 2.5. List price: For 200 licenses, $7,600. Veritas Software Corp., Mountain View, CA; 650-335-8000; *www.veritas.com.* PC

PC MAGAZINE EDITORS' HOT LINKS

www.pcmag.com/hotlinks

We connect you to three Web sites that provide online backup services and to a bulletin on online backup products.

➤Atrieva Corp.
www.atrieva.com
Atrieva is a popular online backup service that is resold by many vendors. The service is free for up to 10MB of storage and is also one of the only solutions to provide a Web interface for storing and retrieving files.

➤@Backup
www.atbackup.com
This online backup service is limited to 100MB of storage, and you must sign up for a year at $99. For this price, @Backup provides an unlimited number of backups and restores. It's a good solution for storing basic data.

➤Connected Online Backup
www.connected.com/solutions/cob_main.htm
One of the first online backup services, COB is designed for corporate users and doesn't have a limit on the amount of disk space per user. Monthly costs start at $18.

➤IDC
www.stac.com/replica/idc2_whitepaper.html
At this URL, you'll find an IDC white paper that discusses the need for online backup and how these products and services compare with traditional tape-backup software packages.

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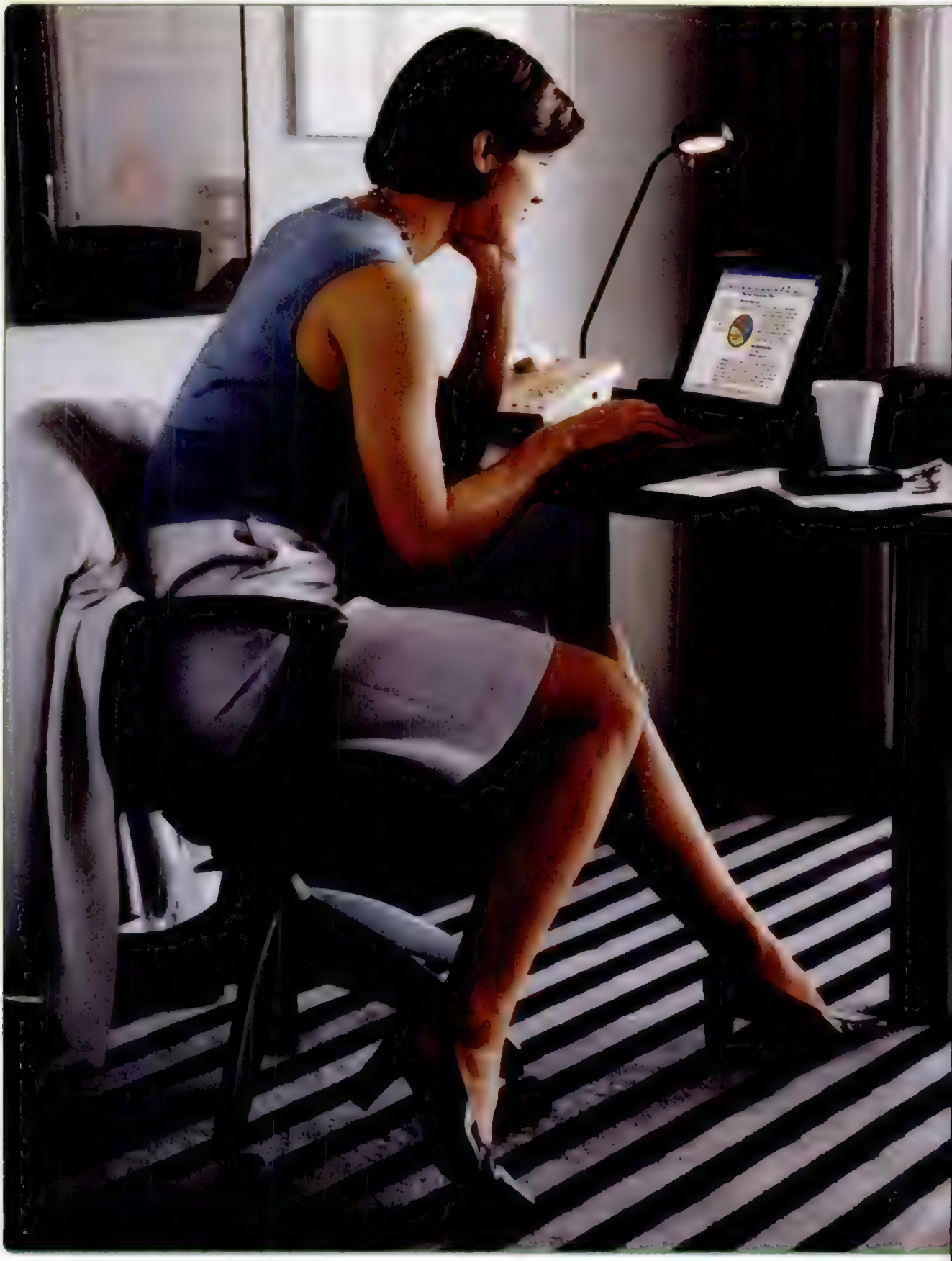

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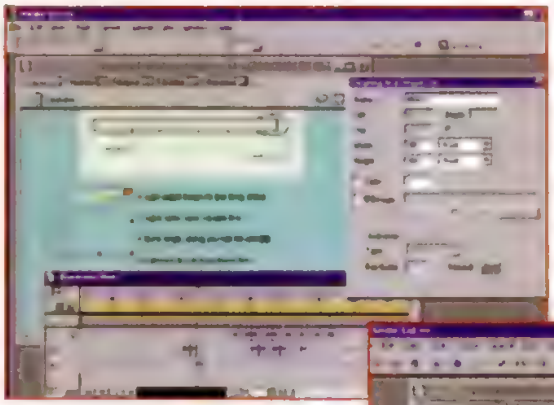
Easy Web Authoring

Adobe GoLive 4.0 has become cross-platform and provides additional power and ease of use.

By Luisa Simone

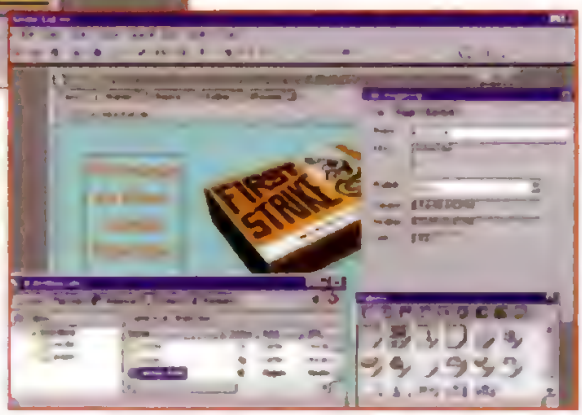
Until recently, the high-end Web authoring tool GoLive CyberStudio was a Mac-only product. Adobe's recent purchase of GoLive and the company's commitment to cross-platform graphics has resulted in the speedy release of Adobe GoLive 4.0 ($300 street, $100 upgrade). GoLive combines robust site management functions with advanced WYSIWYG design tools. And support of Cascading Style Sheets (CSS), Dynamic HTML (DHTML), and JavaScript provides the power necessary to produce animated, interactive Web sites.



▼ **ELEMENTARY:** *GoLive's workspace has two windows that display site information and the open HMTL page. Palette and Inspector let you create and format elements quickly. The site window reports errors such as broken links and missing files.*

Two main windows let you work on site structure and design individual pages, respectively. Tabs within each of the windows provide quick access to specialized functions. For example, in the site window, you can tab between a files-and-folder view or a hierarchical site designer.

The site window also provides easy access to commonly used resources such as external URLs and colors. Tabs in the document window let you create pages in a WYSIWYG layout editor, create framesets, access HTML source code, or preview a page without invoking a browser.



▲ **ANIMATE:** *You can create DHTML animations by inserting keyframes into GoLive's Timeline editor. The Inspector works in conjunction with the Timeline, so you can specify location, visibility, and layering for each keyframe.*

BUILDING YOUR DESIGN

Assembling a design is as simple as dragging container elements (such as text boxes, tables, picture frames, and form-control objects) from the Palette window to a page. Like NetObjects Fusion, GoLive offers a special Layout Grid that lets you position objects with pixel-level accuracy.

You finalize the design using the context-sensitive Inspector palette, which lets you specify attributes for individual elements, such as URLs and source files. The Inspector palette is an integral part of the program. For example, it provides a structured, easy-to-understand mechanism for producing Cascading Style Sheets.

Typically, Web designers don't want to hand-code in HTML. And so wherever possible, GoLive provides alternatives. For example, instead of typing in URLs, you can use GoLive's unique point-and-shoot tool to "draw" links or reference assets. You can also drag CyberObjects or Actions, which are ready-to-use JavaScript or DHTML behaviors, from the Palette onto a page.

Like its chief competitor, Macromedia Dreamweaver, GoLive can produce fully animated DHTML pages. In addition to a timeline in which you can insert keyframes and cue actions, GoLive can record a motion path as you drag an object around the Layout window. During testing, we encountered a minor glitch that made accessing the Timeline impossible. Disabling the default preferences file solved the problem.

MORE POWER FEATURES

If you are using video on your Web site, you'll love GoLive's unique QuickTime editor, which lets you manipulate multiple video, sound, and text tracks in a movie. We found the ability to add one or more URLs to the HREF track to be the most useful feature.

GoLive does an excellent job of tracking the elements of a Web site—alerting you to missing assets or broken links. The preview functions realistically simulate how your Web site will appear in older browsers and on different platforms.

GoLive offers rudimentary support of the next wave of Web programming languages such as Extensible Markup Language (XML), Microsoft Active Server Pages (ASP), and Apple's WebObjects. Though you can view pages and even edit XML source code, you can't use GoLive's visual layout tools to modify these special tags.

Unlike Microsoft FrontPage or NetObjects Fusion, GoLive does not provide either templates or clip art. Instead, such mechanisms as Stationery and Component objects let you store and reuse your original content. For example, if you create custom HTML components, which GoLive will reference rather than import, editing the source code of the component updates all instances of it on a Web site.

GoLive doesn't yet feel like an Adobe app. Standard interface conventions, such as keyboard shortcuts for pan and zoom, collapsible palettes, and a true layer manager, are noticeably absent. And GoLive does not currently offer integration with other Adobe products. In this regard, GoLive loses points to Macromedia Dreamweaver, which is tightly integrated with its sibling program Fireworks.

We'd also like to see Adobe expand its internal multimedia controls beyond QuickTime to include other standard Web formats such as Flash, RealVideo, and Shockwave. In the meantime, we recommend Adobe GoLive 4.0 to professional Web developers who are looking for the right mix of administrative control and creative freedom.

Adobe GoLive 4.0. Street price: $300; upgrade, $100. Requires: 32MB RAM for Windows 98, 64MB RAM for NT; 50MB hard disk space; Microsoft Windows 98 or NT 4.0 with Service Pack 3 or later. Adobe Systems Inc., San Jose, CA; 800-833-6687; *www.adobe.com.*

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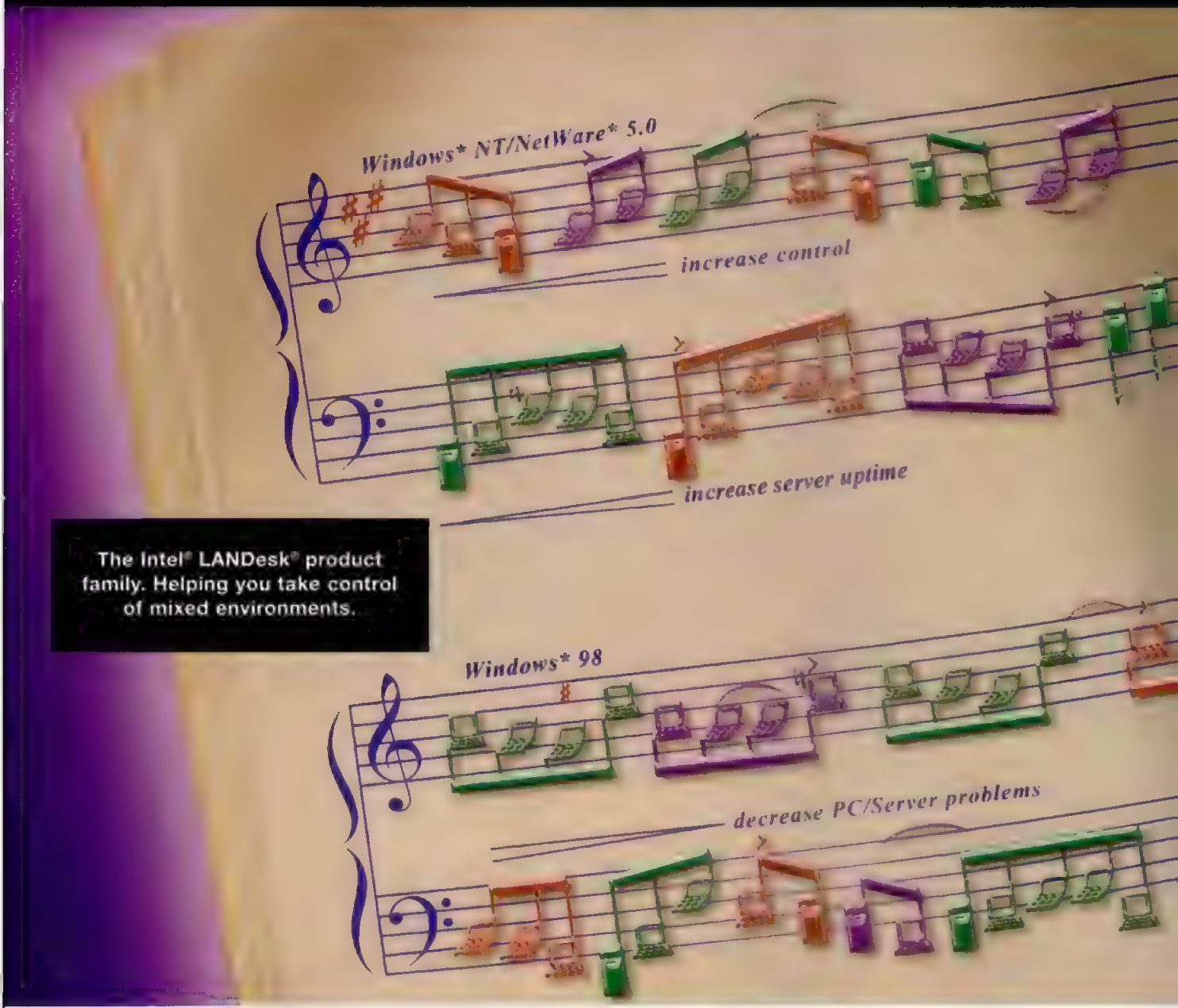

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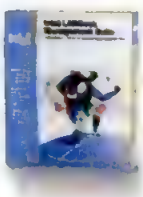

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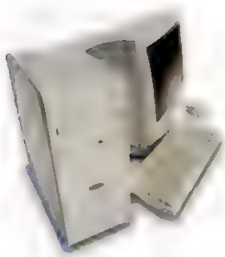

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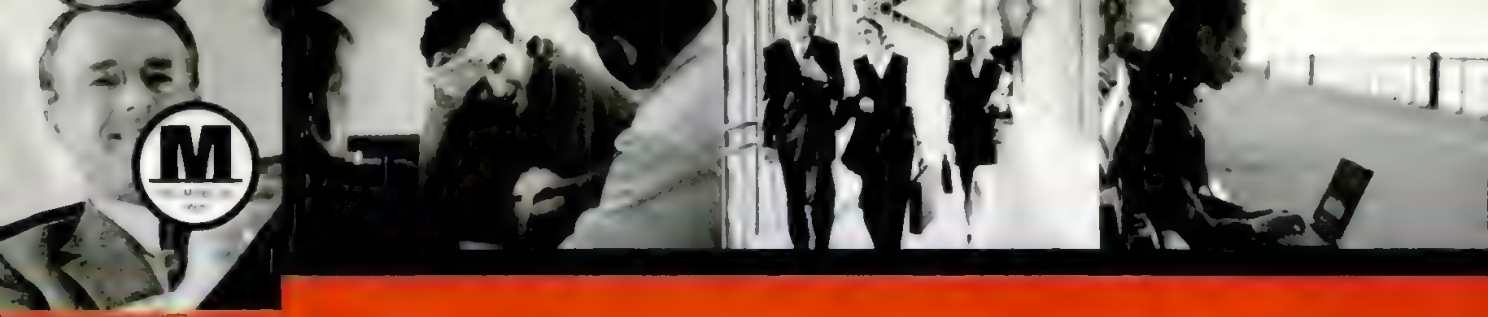

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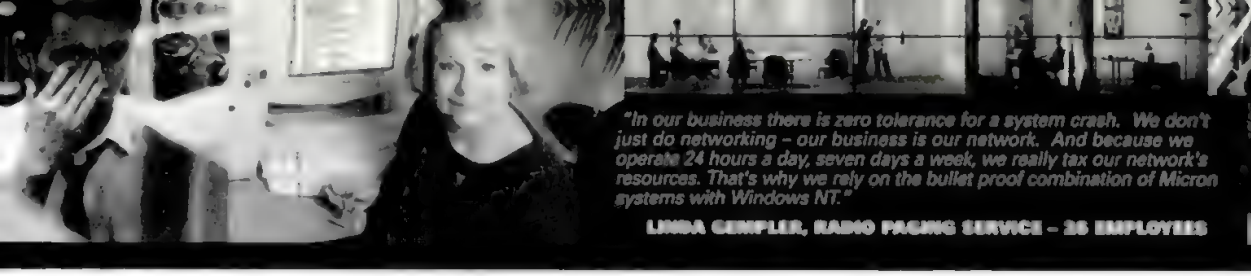

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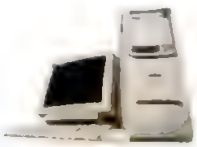

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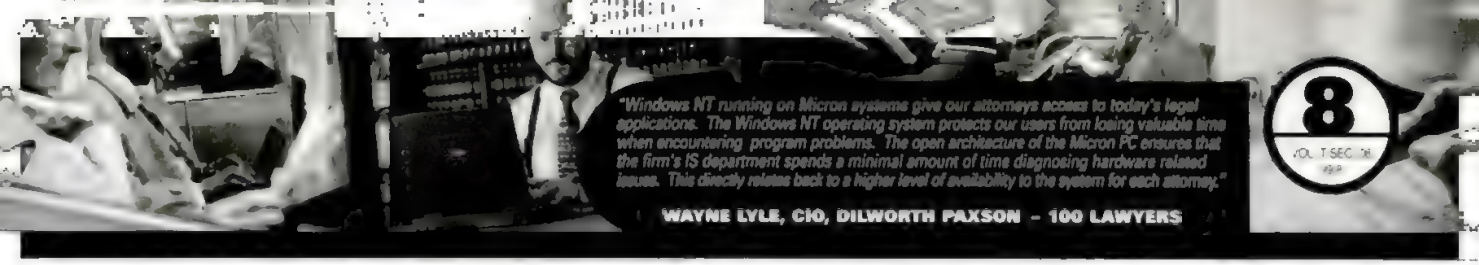

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Maximum PC, May 1999

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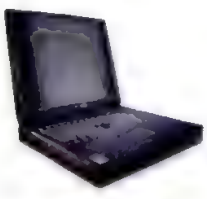

Model Name	TransPort TREK[2] 400	TransPort NX 333	TransPort NX 400
Processor	Intel Pentium II processor 400MHz	Intel Pentium II processor 333MHz	Intel Pentium II processor 400MHz
RAM	64MB SDRAM	64MB SDRAM	128MB SDRAM
Hard Drive	4.3GB hard drive* (removeable)	6.4GB hard drive* (removeable)	14GB hard drive* (removeable hard drive. 28GB option with 2 drives.)
Monitor	12.1" SVGA TFT display	15" XGA TFT display	15" XGA TFT display
Graphics	8MB AGP graphics accelerator	8MB AGP graphics accelerator	8MB AGP graphics accelerator
CD-ROM	24X var. speed CD-ROM drive°	24X var. speed CD-ROM drive°	24X var. speed CD-ROM drive°
Extra Storage	3.5" floppy disk drive (dedicated bay)	3.5" floppy disk drive (dedicated bay)	SuperDisk LS 120
Software	Microsoft Windows® 98	Microsoft Windows NT Workstation 4.0	Microsoft Windows NT Workstation 4.0
Micron U	1-year free[4] training @ Micron U online	1-year free[4] training @ Micron U online	1-year free[4] training @ Micron U online
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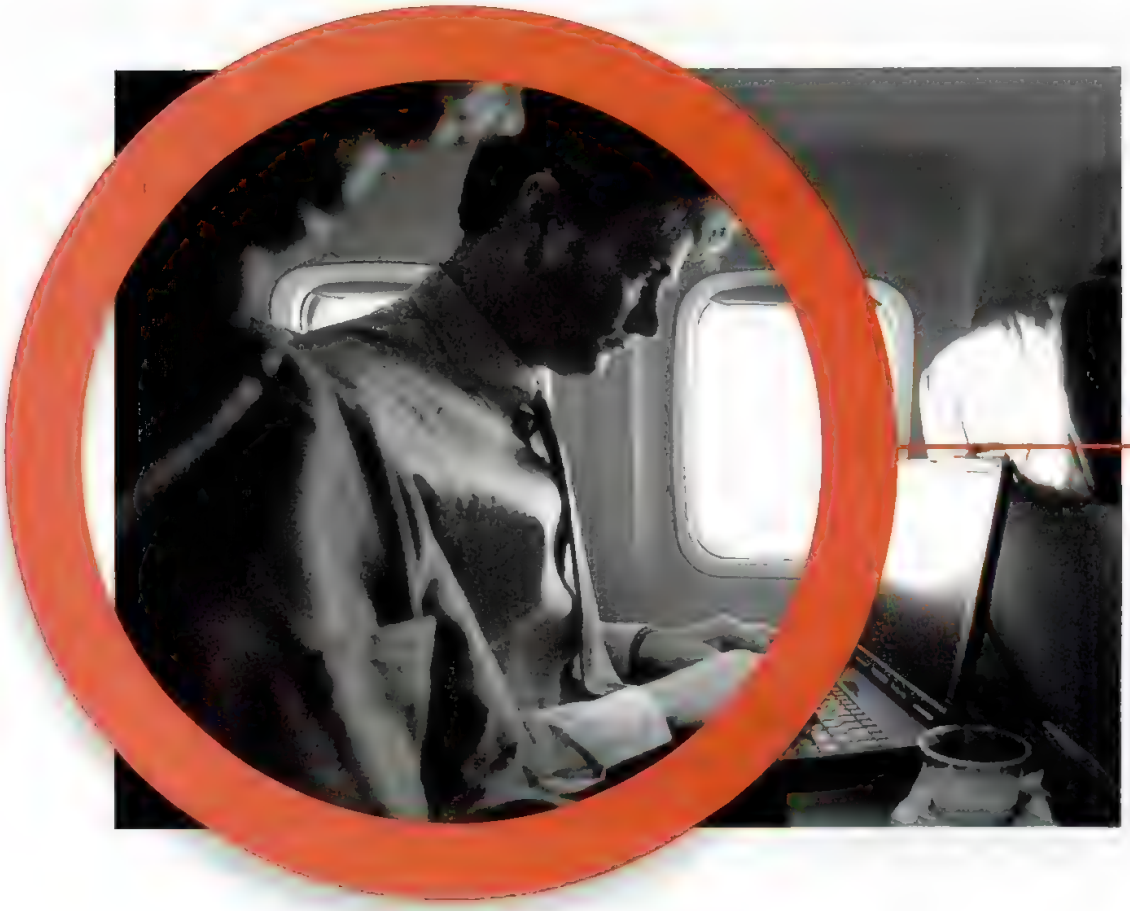

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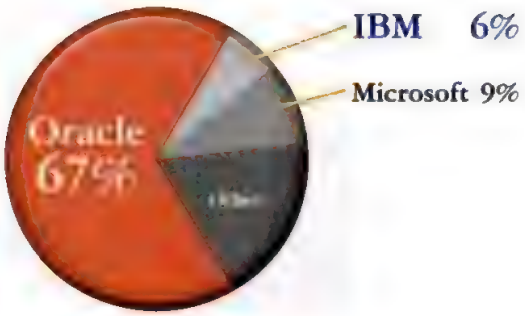

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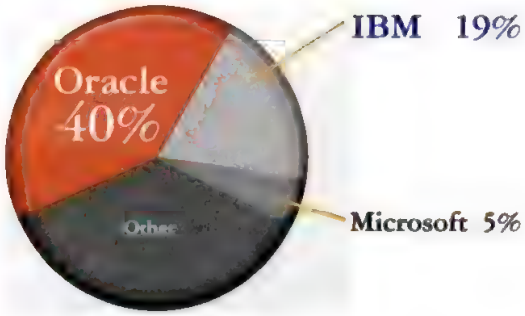

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Web Music

With Jukebox 4.0, MusicMatch takes on RealNetworks for control of your MP3 files.

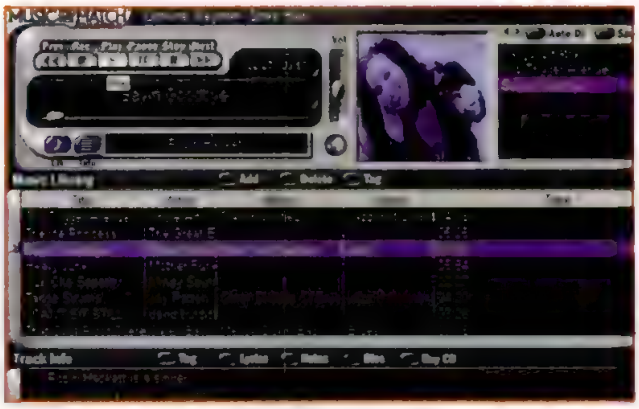
By Jan Ozer

MusicMatch owned the MP3 category until RealNetworks introduced RealJukebox, a polished product that quickly grabbed both market and mind share. But with MusicMatch Jukebox 4.0, the company adds significant database and play list flexibility, a graphics equalizer, and the ability to record from analog sources. Although the interface isn't perfect, the result is a product that many MP3 junkies will find superior to RealJukebox.

You can download a free version of Jukebox from the MusicMatch Web site, which will encode to MP3 and RealAudio 4.0 formats to a maximum of 96 Kbps. With the $29.99 (direct) upgrade, you can record at 128 and 160 Kbps for CD quality playback.

The program has four main windows for the player, library, recorder, and track information, with four different display themes. Drop in a CD and the program scans and imports artist, album, and song titles from CDDB. Check which songs to record, press Start, and the program plays and records in real time. For faster recording you can mute the playback, but MusicMatch doesn't offer RealJukebox's read-ahead encoding feature, a deficit offset by advanced encoding options such as fade and normalization controls.

All recorded files are included in the library, and you can add files from disk through normal menu controls. Since MusicMatch supports the proposed ID3v2 standard for including text and graphics with an MP3 audio file, you can add cover art, notes, and tags for up to 12 characteristics, such as mood, genre, or tempo. Tagging also sets up MusicMatch's AutoDJ function, a great feature that lets you set a program time and select songs by up to three of these tags.



▲ **PICTURE THIS:** *Via support for ID3v2, MusicMatch lets you add graphics or text to your encoded music.*

At times, MusicMatch's fixed window interface feels claustrophobic, and rough edges such as the lack of network support can get frustrating. ID3v2 support and AutoDJ, however, are two features that favorably distinguish MusicMatch from RealJukebox.

MusicMatch Jukebox 4.0. Direct price: Free; upgrade for high bit-rate encoding, $29.99 direct. Requires: 16MB RAM (32MB for Microsoft Windows NT); 30MB hard disk space; Windows 95, 98, or NT 4.0. MusicMatch Inc., San Diego; 619-385-8367; *www.musicmatch.com.*

Piggyback PIM

Carry your PDA on the back of the Motorola StarTAC cell phone for one-touch dialing.

By Bruce and Marge Brown

If your Motorola StarTAC mobile phone is your lifeline, you can fortify it with the Motorola StarTAC with clipOn Organizer ($250 street), a portable PIM device that attaches snugly to the back of the StarTAC phone. This clever combo provides PIM viewing, minor editing, and PC two-way synchronization, along with one-button calling to phone numbers in the Contacts, Calendar, and To Do files. Lacking only a backlit display, the Organizer is innovative, sturdy, versatile, and powerful—a must-have for StarTAC phone users.

▲ **HAND-PICKED:** *A choice for right-handed or left-handed screen configuration is included in the Organizer's Preferences.*

With the inclusion of Starfish Software's proven TrueSync Plus program, the Organizer synchronizes with limitless combinations from an impressive list of PIMs, which includes versions of ACT!, Lotus Notes and Organizer, Microsoft Outlook and Windows CE, and TruSync Desktop (included), as well as with Internet PIMs—Excite, TruSync.com, and Yahoo! A serial cable for the PC connection is included.

With 512K of memory, the 2.2-ounce, 3.9- by 1.9- by 0.8-inch (HWD) Organizer stores an estimated 1,000 contacts and 12 months of appointments—not as space-efficient as Franklin Electronics' Rex Pro, which stored more than 3,000 contacts in testing (with the same memory capacity). The greatest number of contacts we could synchronize from Outlook 98 to the Organizer was 1,750.

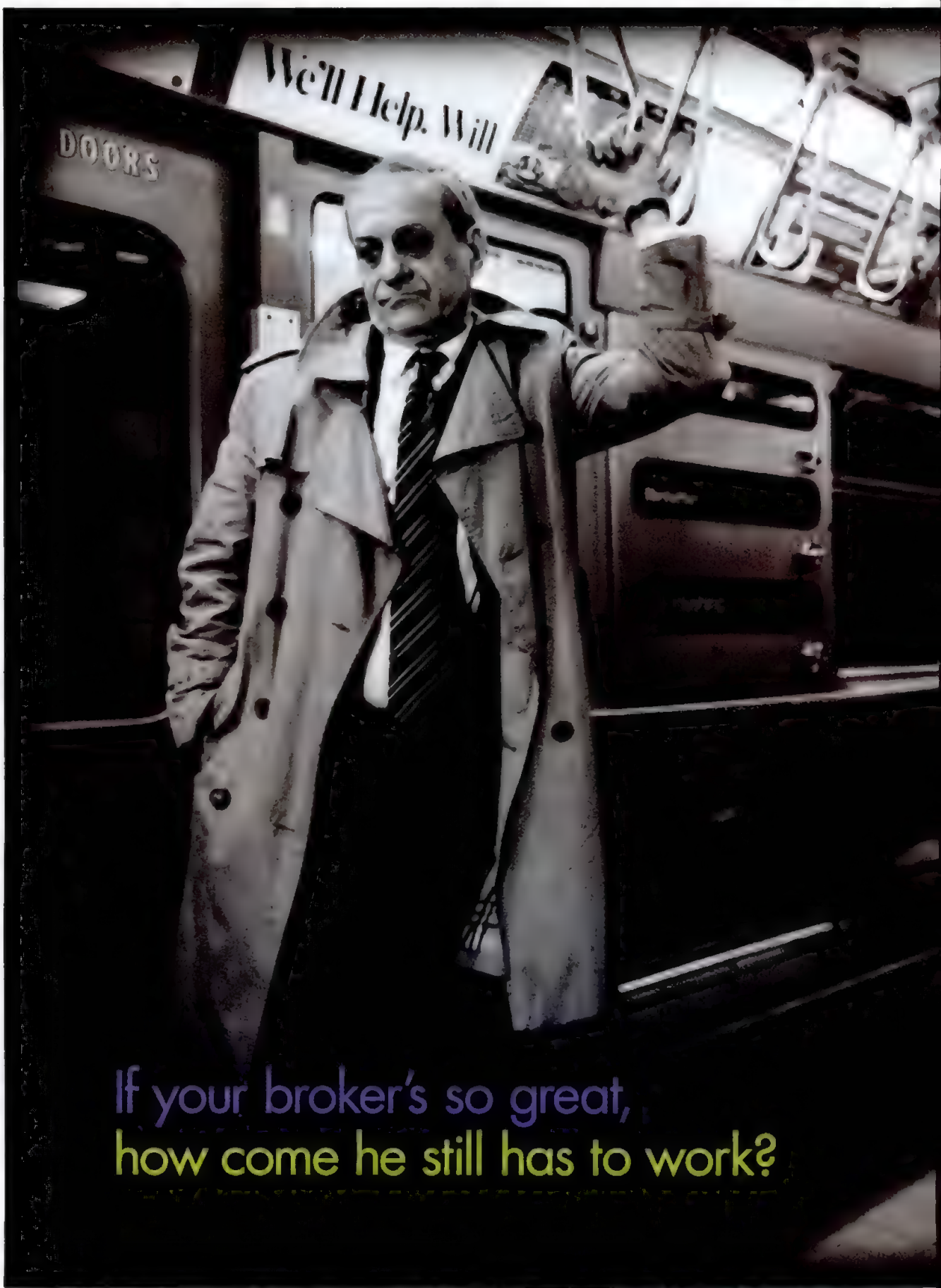
We tested the Organizer with a StarTAC ST7760 phone and found it comfortable to hold, not too heavy with its combined weight of 6.6 ounces. The Organizer uses the phone's auxiliary battery connector but does not drain the phone's battery; rather, it is rated to run for nine months on two lithium batteries. It can work as a standalone PIM without requiring a phone.

We found the one-touch dialing feature intuitive in testing. You simply scroll to the number, hit the button with the telephone icon, and the phone dials. Although its 240- by 136-dpi resolution screen is small at 2.1 by 1.4 inches (LW), standard PIM data is easily viewable from the icon driven menus and seven tiny control keys. You can set up Quick List menus at the desktop to download to your Organizer for input shortcuts.

The Organizer will please not only existing StarTAC phone users, but it will likely attract new users to StarTAC phones and calling services—a home run for Motorola.

Motorola StarTAC with clipOn Organizer: Street price: $250. Requires: 8MB RAM; 15MB hard disk space; Microsoft Windows 95, 98, NT 4.0 or higher. Motorola Inc., Libertyville, IL; 800-331-6456; *www.motorola.com.*

PHOTOGRAPHY BY THOM O'CONNOR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Viewable Image Size	18.0"	18.0"	18.0"
.26mm Dot Pitch or Better?	Yes	No	No
1,280 x 1,024 @ 88Hz	Yes	No	No
TCO Certified	Yes	Yes	No
PC Magazine Editors Choice	Yes	No	No

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Going Ultramobile

The new Toshiba Portégé 3110CT takes ultramobile computing to new heights.

By Carol Venezia

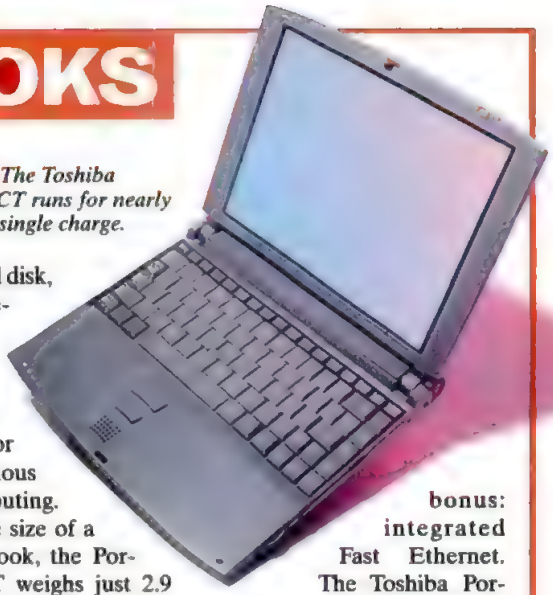
The Portégé series from Toshiba has set the standard for ultramobile PCs. The new Toshiba Portégé 3110CT ($2,300 street) integrates groundbreaking technology to address the problem that many mini-notebooks with fast processors have: short battery life.

The Portégé 3110CT is the first notebook on the market to use a low-temperature polysilicon (LTPS) TFT display panel. Polysilicon is a material that can achieve higher electron mobility than the amorphous silicon used in typical LCD panels. So the driver circuitry that controls the panel can be integrated on the polysilicon substrate, eliminating the need for externally mounted driver circuits.

Driver integration means that component count can be reduced by up to 40 percent, and the number of connections needed in an LCD module system is reduced by 95 percent. This results in a lower-power, thinner, brighter display that's more durable.

This 10.4-inch SVGA display is part of the reason the Portégé 3110CT is so thin—0.8 inches. Instead of a cooling fan, the system reduces CPU clock speed when a certain temperature is reached to control heat. But the machine proved itself on our BatteryMark test, lasting an impressive 2 hours 40 minutes.

A 300-MHz Mobile Pentium II processor powers the Portégé 3110CT; most other thin machines on the market use Pentium chips because they draw less power. Add to this 64MB of RAM (upgradable to 128MB), a 6.2GB hard disk, and an integrated 56K V.90 modem, and you're ready for some serious mobile computing.



▶ **LONG LIFE:** *The Toshiba Portégé 3110CT runs for nearly 3 hours on a single charge.*

About the size of a spiral notebook, the Portégé 3110CT weighs just 2.9 pounds, or about 3.5 pounds with AC adapter. Also integrated are a Type II PC Card slot, microphone and headphone jacks, a USB port, and a Fast-IR transceiver.

Missing are video-out, serial, and parallel ports. For those, you'll need the included port-expander bar, which plugs into the right side of the machine. The port expander is a bit of a hassle, but it does have an added bonus: integrated Fast Ethernet.

The Toshiba Portégé 3110CT showcases the company's strong point, which is integrating advanced technology that benefits the user, not making a fashion statement. But as for the latter, this machine's cool silver magnesium case should do the trick.

Toshiba Portégé 3110CT. Street price: $2,300. Toshiba America Information Systems Inc., Irvine, CA; 800-867-4422; *www.toshiba.com.*

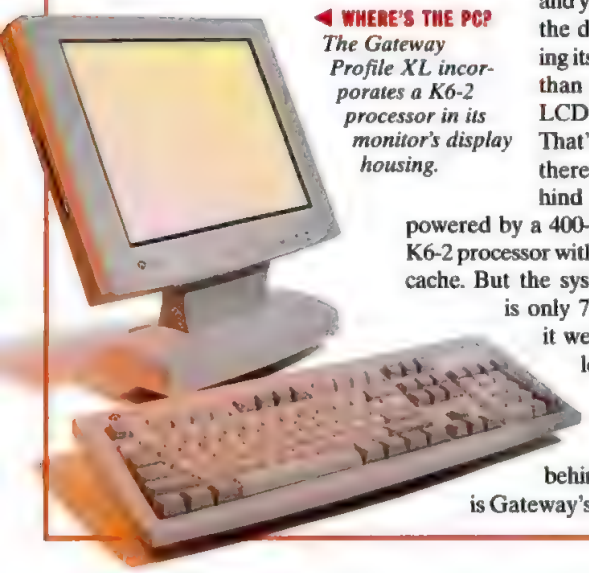
An Affordable LCD PC

The new Gateway Profile XL may look like an LCD monitor, but there's a PC hiding inside.

By Carol Venezia

Are you tired of that ugly beige box sucking up too much desktop real estate? Gateway has a solution, with the new Gateway Profile XL ($2,199 direct). This highly integrated, all-in-one LCD PC is perfect for space-constrained areas, and it's actually affordable.

Turn the Profile XL sideways, and you'll see that the display housing itself is thicker than the average LCD monitor. That's because there's a PC behind the glass, powered by a 400-MHz AMD K6-2 processor with 512K of L2 cache. But the system's depth is only 7 inches, and it weighs slightly less than 18 pounds. Part of the secret behind the design is Gateway's use of components traditionally found in notebook PCs. The floppy disk drive, 6.4GB hard disk, and 4X DVD-ROM drive all fit this description; the floppy disk and DVD drives are vertically mounted and can be accessed from the left and right sides of the machine, respectively. At the back of the display are two SO DIMM slots; each can hold a 128MB module.



◀ **WHERE'S THE PC?** *The Gateway Profile XL incorporates a K6-2 processor in its monitor's display housing.*

The centerpiece of the Profile XL is its 15-inch XGA LCD panel. With 4MB of SGRAM coupled with its ATI Rage LT Pro graphics accelerator, you can display at color depths of up to 32-bit. We found the panel bright and readable dead on; off-axis viewing was shadowy.

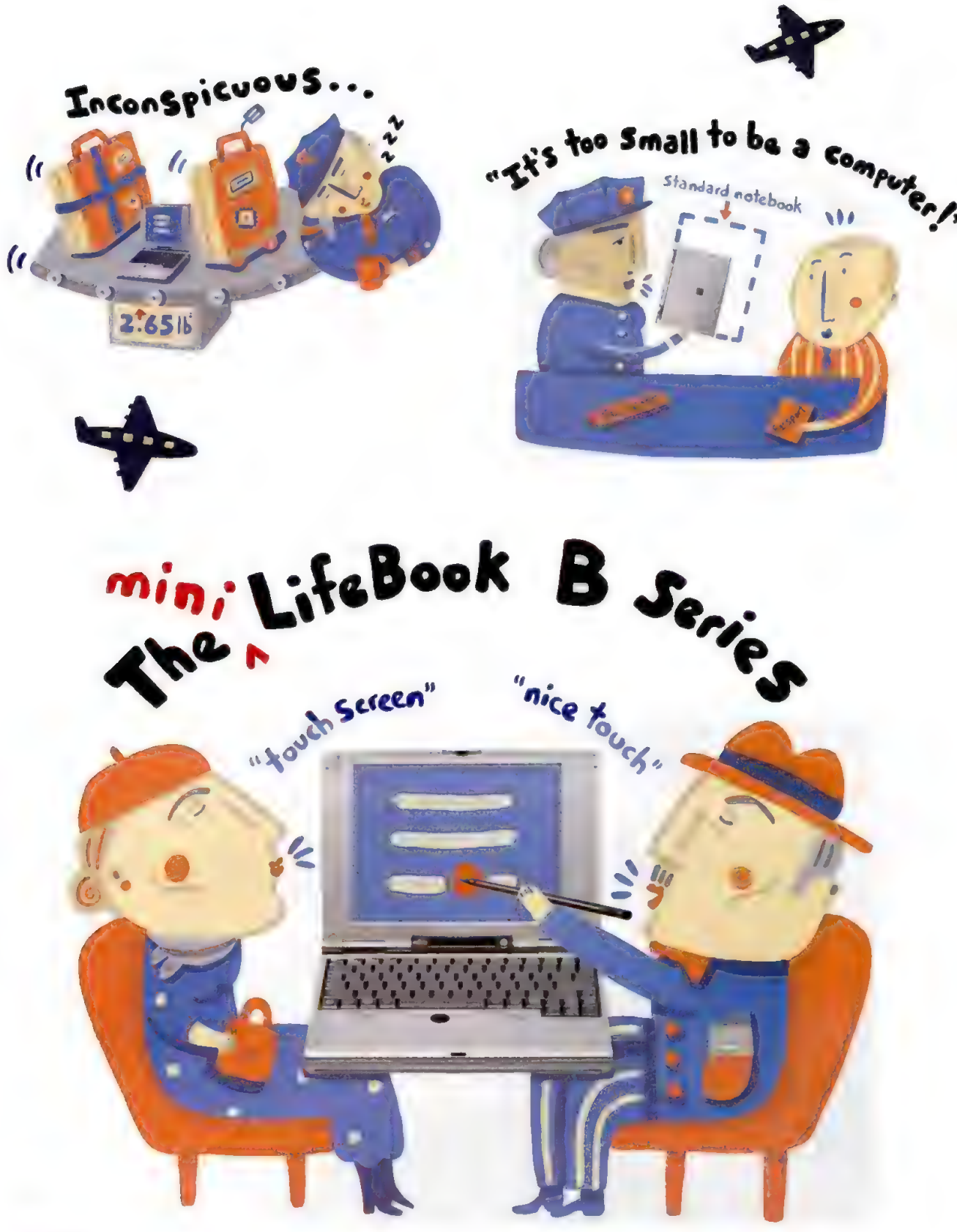
On the bottom edge of the display housing are controls for the PC and the LCD. To the left are a volume-control thumbwheel, a headphone jack, and a microphone. Moving to the right, you'll find brightness control buttons—although on our test machine, they didn't appear to do much.

Behind a removable plastic panel on the back of the system are RJ-11 and RJ-45 jacks for the integrated V.90 modem and Fast Ethernet controller, respectively, as well as two vertically integrated, stacked Type II PC Card slots. And to the right are joystick and video-out ports. There are also two USB ports in the base, as well as jacks for hooking up speakers in case you find the integrated speakers lacking.

The Profile XL's score of 14.2 on our ZD Business Winstone 99 tests was in line with the most recent K6-2/400–based PC we tested in February (or a little over half of what you'd get from a Pentium III/550). But the point of this machine isn't barn-burning performance. At a price that's just a bit more than what you'd pay for the pieces separately, the Gateway Profile XL will ably meet the needs of its target audience.

Gateway Profile XL. Direct price: $2,199. Gateway, North Sioux City, SD; 800-846-4208; *www.gateway.com.*

PHOTOGRAPHY BY THOM O'CONNOR



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[1] Starting estimated street price on B112. Subject to change. [2] Weight is approximate and may vary.

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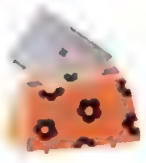

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A New Crop of Printers

We review two ink jets, one photo printer, and a laser printer, from Canon, Epson, and Lexmark.

By Bruce and Marge Brown

Increasingly, new printers coming to market are targeting specific user needs. Here's a miniroundup of the latest printers marketed for homes and small offices.

CANON BJC-5100

High speed isn't the only reason to buy the Canon BJC-5100 color ink jet printer ($180 street). It prints normal monochrome and color text and graphics at 360- by 360-dpi or 720- by 720-dpi resolutions with standard color and black print heads. The unit is capable of 1,440 by 720 dpi when printing black or color on special media or when printing photographic images with an optional photo color printhead ($46.95 list).

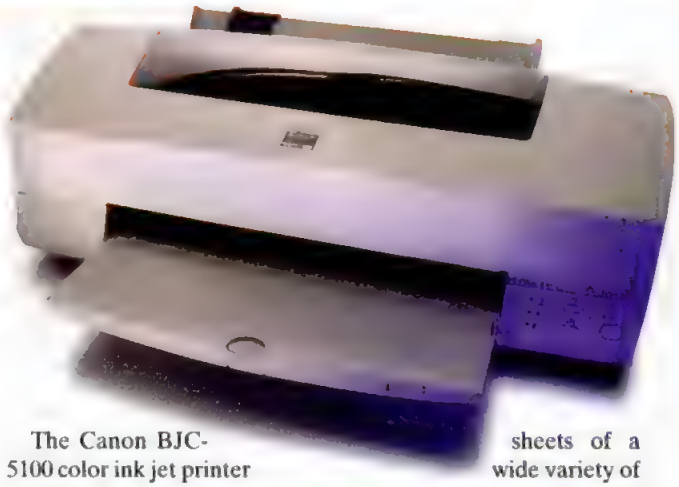
The BJC-5100 is fairly large, measuring 11.8 by 19.6 by 25.0 inches (HWD) with all trays extended. The input-tray paper capacity for normal size stock is 130 sheets, but a manual feed slot accepts single sheets as large as 11 by 17 inches.

The printing quality and speed of the BJC-5100 is attained by its use of a variety of printheads and ink cartridges in eight combinations. The printer comes standard with a color printhead and an Enhanced Black printhead ($36.95 list for a replacement). The color printhead holds a three-color ink tank ($21.95 list) and a small black tank ($8.25 list). Rated ink costs per printed page are 4 cents for 5 percent black-text printing and 16 cents for 15 percent color printing.

The BJC-5100 attains its highest speed in dual-cartridge, shuttle-printing mode with two black-ink cartridges installed. In testing, the printer took 22 seconds to print a 1-page Microsoft Word document with one black-ink cartridge installed and 19 seconds with two cartridges. A 25-page mixed-text document (with multiple fonts, sizes, and tables) printed in 5:12 (minutes:seconds) with one cartridge and 5:02 in dual-cartridge mode. The text output was laser-sharp.

Photo printing in highest quality is actually seven-color printing—three colors plus black in the standard color cartridge and three photo colors in the photo cartridge. In highest quality mode on glossy paper, the BJC-5100 took 13:27 to print a 5- by 7-inch photo.

▼ VERSATILE: *The BJC-5100 delivers paper-handling ease at a low price.*



The Canon BJC-5100 color ink jet printer isn't the best choice for printing a lot of photographs, but its text printing speed, paper-handling versatility, and low price make it worth considering for low-volume business and home-office applications.

▲ MULTITASK: *Though geared to photographers, the 1200 also functions well as a text and color graphics printer.*

Canon BJC-5100. Street price: $180. Canon Computer Systems Inc., Costa Mesa, CA; 800-652-2666; *www.ccsi.canon.com.*

EPSON STYLUS PHOTO 1200

Epson is replacing last year's Editors' Choice home-photo printer, the Epson Stylus Photo EX (see "Picture-Perfect," November 3, 1998), with the Epson Stylus Photo 1200 ($500 street). The 1200 matches many of the features of the Epson Stylus Photo 750 (reviewed in "Photo Finishes," May 25), including speed, print resolution (1,440 by 720 dpi), and small ink-droplet size (6-picoliter drops versus the EX's 11) for fine image detail, and it has even better paper handling, higher capacity ink cartridges, and a photocentric software bundle. To top it all off, photo print quality is just short of amazing.

The beige 1200 is sizable, at 15.5 by 22.3 by 31.5 inches (HWD) with all trays extended, with a hefty 22- by 10.5-inch (LW) footprint. The feeder tray holds up to 10 envelopes or 100 sheets of a wide variety of stock, ranging in size from 3.5 by 3.5 inches to 13 by 44 inches. The 1200 can do full-bleed tabloid (11- by 17-inch) print using 13- by 19-inch stock.

Quality test prints were knockouts. While last year's EX is still one of the best ink jet photo printers available, the 1200 is even better, producing extremely smooth prints indistinguishable from conventional film prints. Epson's PhotoEnhance3 technology adjusts for exposure, contrast, saturation, and brightness.

The 1200 is not a match in printing speed for conventional printers such as the Epson Stylus Color 900 or the 740. But for a printer intended primarily for printing photo images at high-quality levels, the 1200 does a great job of printing regular text output with reasonable speed.

Testing with USB connectivity equaled the results of the Epson Stylus Photo 750. A 4.5- by 7-inch color photo in Photoshop 4.0 LE high-quality mode printed in 3:46 (versus 3:35 with the 750), and a 25-page text document in standard mode printed in 13:23 (versus the 750's 12:58). Connected via a parallel port, the 1200 matched the USB speed for text printing but took 6:09 to print the color photo.

The Epson Stylus Photo 1200 provides versatile connectivity,

PHOTOGRAPHY BY THOM O'CONNOR

with its parallel, USB, and Macintosh ports. Replacement black-ink cartridges cost $25 (street), and the six-color cartridges cost $30 (street). The rated per-page costs are 9 cents for color and 7 cents for black and white.

Amateur photographers who want expanded printing capabilities would do well to consider the Epson Stylus Photo 1200. **Epson Stylus Photo 1200.** Street price: $500. Epson America Inc., Torrance, CA; 800-463-7766; *www.epson.com*.

LEXMARK OPTRA E310 LASER PRINTER

The Lexmark Optra E310 Laser Printer ($400 street) adds an extra dimension to relatively low-cost business printing: In addition to standard PCL6, PCL5e, PCLXL, and Postscript 2 compatibility, the sturdy and compact Optra has both parallel and USB interface ports. With an 8-ppm rating, the 600- by 600-dpi, true-resolution Optra can print at a maximum 1,200-by-1,200 resolution with image enhancement and proved in testing to be a speedy, economical text printer.

The Optra measures 14.5 by 13.8 by 18 inches (HWD) with all trays extended, with a footprint of only 12 inches wide and 13.8 inches deep. The input tray holds 150 sheets of letter- or legal-size paper or 10 envelopes, and the output tray holds 100 sheets of paper. This printer is best suited for printing text; its 10,000-page-per-month duty cycle makes it a good choice for large print jobs.

The Optra comes standard with 2MB of memory, which falls short for printing huge graphics files—though it's expandable to 66MB. Memory expansion options are costly, ranging from 4MB ($46.80 list) to 64MB ($958.80 list). The printer can also use optional flash memory for downloading fonts or macros.

The single-piece toner replacement cartridge costs $94 (list). With its rated 5,000-page yield, this results in an attractively low 1.9-cents-per-page consumables cost.

Installing the Optra was uneventful in both parallel and USB modes. If you use the USB connection, though, a couple more steps are required: You first install the printer choosing LPT1 as the printer interface. After the printer drivers have been loaded, you select the proper USB port. The printer is easy to use, with Ready, Data, Load Paper, Paper Jam, and Error lights and a reset button on the front panel.

In testing, print speeds were virtually identical in parallel and USB modes, and in PCL and Postscript emulations. The Optra required an average of 21 seconds to print 1 Word text page and 3:34 to print a 25-page mixed-text document. Text quality was typically laser-sharp. In PCL mode, the Optra took 4:46 to print a 5- by 7-inch photographic image in 1,200-dpi mode: The printer's standard memory was not sufficient for printing the 8.5MB image in Postscript mode.

▶ **A VALUE:** *Speed in printing and excellent output make the Z51 a great SOHO option.*

▲ **FLEXIBILITY:** *The low-cost Optra comes with both USB and parallel-port connections.*

The Lexmark Optra E310 Laser Printer is a fine choice as a single-user office text printer, with its text-printing speed, compact size, and choice of interface connectivity.

Lexmark Optra E310 Laser Printer. Street price: $400. Lexmark International Inc., Lexington, KY; 800-539-6275; *www.lexmark.com*.

LEXMARK Z51 COLOR JETPRINTER

The Lexmark Z51 Color Jetprinter ($280 street) prints at a maximum resolution of 1,200 by 1,200 dpi, using just 7 picoliters per ink droplet, and is rated to print 10 ppm in black and 5 ppm in color. The printer has both USB and parallel connections and a 100-sheet-capacity paper-input tray, and it measures 13 by 18 by 20.5 inches (HWD) with all trays extended. A banner paper holder pops out of the back of the printer to hold sheets of perforated banner stock. The Z51's USB port adds connection flexibility, and its speed and excellent output make the Z51 a value.

The Z51 comes standard with one black-ink cartridge (replacements cost $29.49 list) and one three-color cartridge ($36.95 list); both are installed for normal printing. To print photographs, you replace the black-ink cartridge with an optional photo cartridge ($39.99 list). Printing costs are rated at 4 cents per page for 5 percent black and 13 cents for 15 percent color printing.

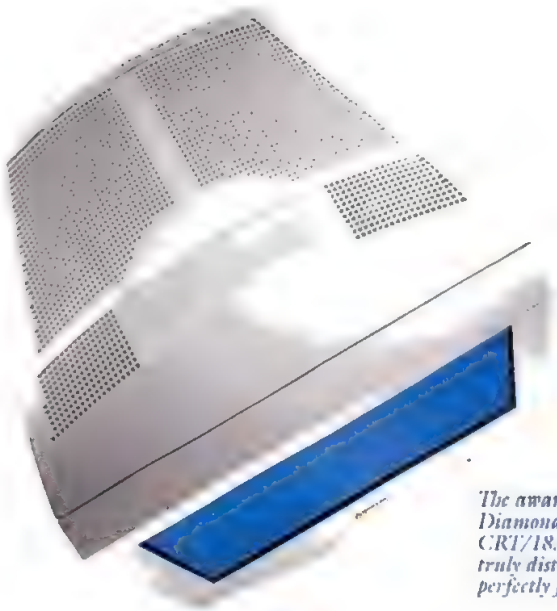
In testing, the Z51 printed a 1-page Microsoft Word file in 20 seconds in USB mode and in 19 seconds connected by parallel cable. A 25-page test took 5:38 with USB and 7:08 via the parallel connection. Printing a 5- by 7-inch photo image in highest resolution on glossy stock took 5:43 via USB but only 4:35 in parallel-interface mode, much faster than the Canon unit and comparable to the speed, if not the output quality, of the much pricier Epson Stylus Color 900 ($450 street).

Like the BJC-5100, the Z51 excelled at printing text and standard graphics. Photo images printed on glossy paper looked fine unless held very close, when thin lines were detectable. In the default color setting, the Z51 appeared to push the red color balance in a series of standard photo test prints. Pushing red often results in pleasing facial tones, but it's not as accurate as balanced color. The Z51's text print samples did not smudge.

All in all, the Lexmark Z51 Color Jetprinter is a fine multipurpose ink jet printer for SOHO use.

Lexmark Z51 Color Jetprinter. Street price: $280 (before $50 rebate). Lexmark International Inc., Lexington, KY; 800-539-6275; *www.lexmark.com*.

Has Your Monitor Been



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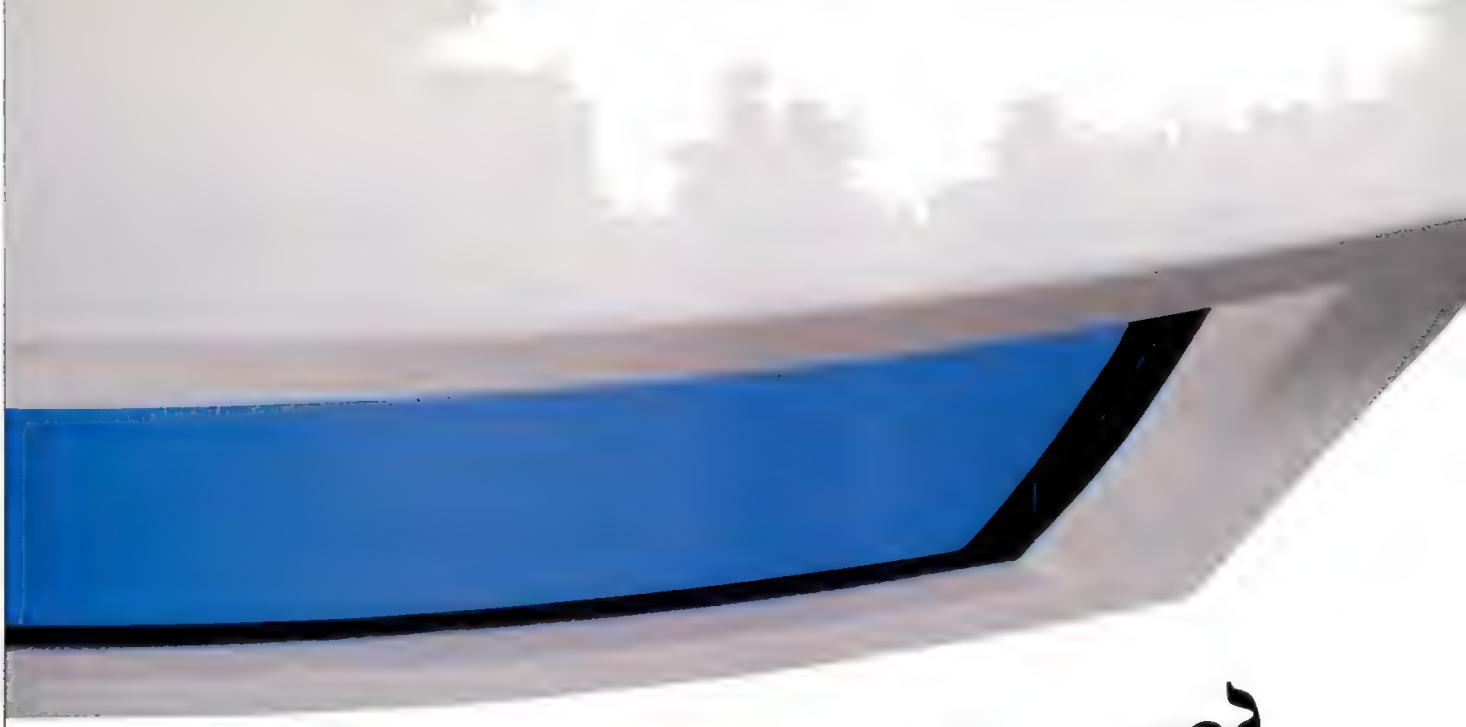
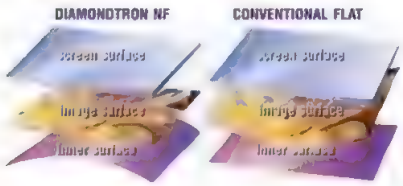


Throwing You A Curve?

If you're using a conventional CRT monitor, your eyes and brain are working overtime to correct for the curvature. Now, however, with its DIAMONDTRON NF™ (Natural Flat) family, Mitsubishi has completely revolutionized monitor technology. With a perfectly flat screen from edge to edge and truly distortion-free imagery, you'll experience an unprecedented improvement in viewing pleasure. Not to mention the dazzling brightness, razor-sharp clarity and stunning color accuracy which puts Mitsubishi in a class by itself. With no curvature, reflections and glare are also eliminated. The result is remarkably realistic, natural-looking flat images. Your energy can now be spent being more creative and more productive. For added versatility, DIAMONDTRON NF monitors feature a unique self-powered USB hub which allows you to switch all connected USB peripherals between two computers automatically. With DIAMONDTRON NF monitors, Mitsubishi will forever change your view of the world. The difference is right before your eyes. For more information on the award-winning Diamond Pro 900u (19-inch CRT/18.0-inch DVI*) and new Diamond Pro 2020u (22-inch CRT/20-inch DVI*) models, contact Mitsubishi Electronics today.

DIAMONDTRON NF



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Look Who's Talking

L&H Voice Xpress Professional 4.0 offers an improved user interface and greater accuracy.

By Greg Alwang

Although speech recognition software has improved significantly in a short time, lengthy enrollment and poor initial accuracy are two elements that continue to frustrate users. L&H Voice Xpress Professional 4.0 ($149.99 list), Lernout & Hauspie's flagship product, breaks down these barriers. Usability and interface enhancements, along with tight integration with Microsoft Office 2000, lead to a smoother speech experience that will appeal to new and seasoned users alike.

Pro 4.0 has a new XpressStart feature that gets new users up and running in about 5 minutes—a far cry from the 45-plus minutes required by previous versions. We installed the software, enrolled, and began dictating in less than 15 minutes on our Pentium II/300 test machine. Initial accuracy was a decent 92 percent, but rose to 97 percent after only 2 hours of use and after running Vocabulary Extender, which learns the words and phrases that you typically use.

The enhanced accuracy and performance are results of an improved language model and a larger vocabulary (over 230,000 words). A new Recognition Advisor provides tips for positioning and tuning the microphone, extending the vocabulary, and creating dictation shortcuts.

We found the bundled Telex microphone far superior to those included with previous Voice Xpress versions. Pro 4.0 also works with the new crop of USB microphones (see the sidebar).

Various dictation shortcuts simplify everyday use. You can now dictate keyboard commands with single words; for example, *Enter* instead of *Enter key*. When spelling Web addresses, you can say "dot com" instead of saying each character. Dictation macros can still be created, but now you can also create Personal Commands that can work globally or be categorized by application.

As with Dragon NaturallySpeaking and IBM's ViaVoice, correcting errors is the key to training Voice Xpress. Pro 4.0 makes better use of your corrections when it tunes the language model. With past versions, you could undo any dictation by saying "undo," but now you can also undo corrections and commands.

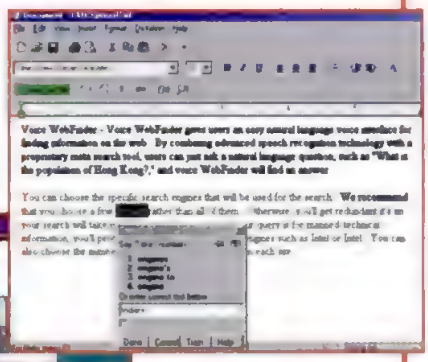
You can control the Windows desktop or any Windows application simply by saying the menu names and menu choices, such as "file menu" and "export" to start an export action. Pro 4.0 adds support for Microsoft Office 2000 features, such as text-label orientation, nested tables, and the new multilevel Office clipboard.

Bundled with Pro 4.0 is L&H Talking Tools, which includes a voice-activated WebFinder, calculator, clock, address book, and scheduler. If you aspire to do most of your daily work by voice, you'll find these tools quite helpful.

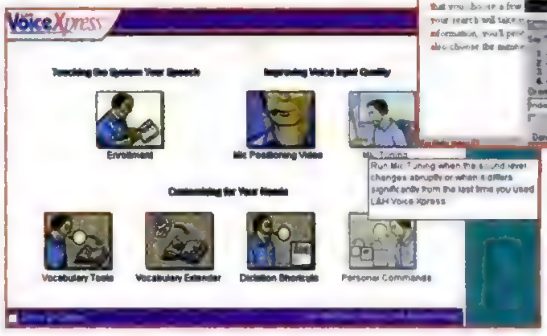
The new XpressRecorder lets you record and edit voice files in WAV format on any PC with a microphone. You can transcribe these WAV files or recordings from a hand-held unit into text with XpressPad Mobile. These tools let mobile users record anywhere and still have the flexibility to use Pro 4.0 to transcribe the results.

L&H Voice Xpress Professional 4.0's abbreviated enrollment appeals to users who want to dive into useful dictation without spending hours in training. The improved accuracy and breadth of its features make Pro 4.0 a powerful voice recognition contender.

L&H Voice Xpress Professional 4.0. List price: $149.99. Lernout & Hauspie, Burlington, MA; 800-380-1234; *www.lhsl.com.*



▼ **HELPING HAND:** *The Recognition Advisor guides you through improving speech input quality and customizing Voice Xpress to help streamline dictation.*

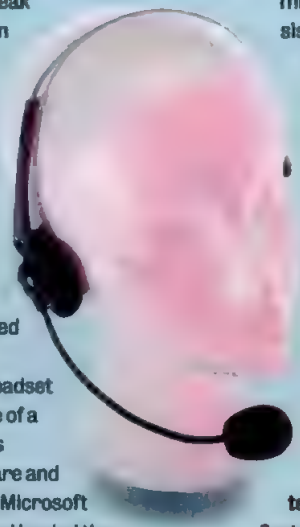


▲ **YOU CHOOSE:** *When correcting dictation in Voice Xpress, you can pick from a list of close matches or spell or say the correction.*

Clear Dictation

Inferior audio systems can wreak havoc with speech recognition accuracy. Dragon Systems offers a solution with the Dragon NaturallyClear USB System H100—a microphone and audio system combo that bypasses a PC's audio system to help minimize problems. The H100 is available separately for $79.95 (list) or bundled with NaturallySpeaking Preferred USB for $249.95.

The H100 consists of a Telex headset tethered to a small brick the size of a deck of cards. The brick contains speech-optimized audio hardware and plugs into an available USB port. Microsoft Windows 98 detected the H100 and loaded the appropriate USB drivers.



This system not only results in consistent, high-quality audio input, but also eliminates audio problems caused by electromagnetic interference. In networked environments where users don't always dictate on the same PC, the H100 can solve the problem of dealing with disparate sound systems. If you experience audio problems, dictate on a laptop or on several PCs with different sound systems, the H100 will surely help clear things up.—*Greg Alwang*

Dragon NaturallyClear USB System H100. List price: $79.95. Dragon Systems Inc., Newton, MA; 800-437-2466; *www.dragonsystems.com.*

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A-LIST

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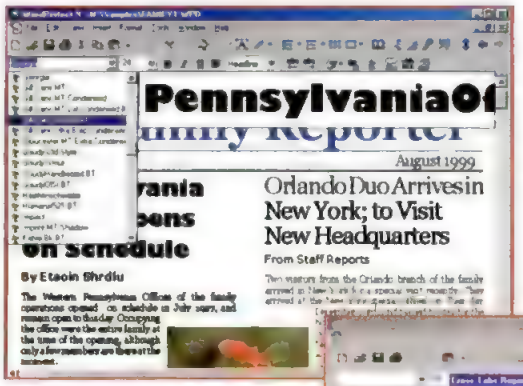
WordPerfect Beefs Up

Corel improves speed, reliability, and compatibility in the alternative office suite.

By Edward Mendelson

Corel's WordPerfect Office 2000 gets the upgrade process right. The main applications from Office 8 keep their classic look and feel, except for the CorelCentral PIM. Once an oversize clunker, CorelCentral is now clean, compact, and efficient. Internet integration is enhanced throughout with industry-standard formats, in contrast to Microsoft Office 2000, which relies heavily on Microsoft-specific extensions.



▶ **GREAT VIEW:** *WordPerfect 2000 previews formatting as you scroll through a list of fonts.*

Compatibility and efficiency were Corel's major goals for this release. File formats are the same as in earlier versions, and the suite can default to opening and saving Microsoft Office files in Microsoft formats. Upgrading is eased by a new Corel Distribute utility that lets system administrators run customized server-based installations.

SOMETHING FOR EVERYONE

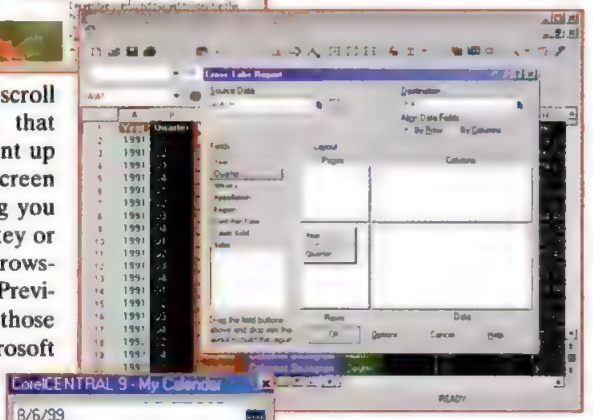
The suite's Standard Edition ($300 street, $100 upgrade) comprises WordPerfect 9, Quattro Pro 9, Presentations 9, CorelCentral 9, the suite's Desktop Application Director toolbar, Trellix 2, and integration with Microsoft Visual Basic for Applications. Integrated add-ons let you publish files in eXtensible Markup Language (XML), Adobe's PDF format, or Trellix-format hyperlinked files.

The Voice-Powered Edition ($350 street, $150 upgrade) adds Dragon NaturallySpeaking 3.0, which is tightly integrated with WordPerfect 9, and Corel Print Office desktop publisher. The Professional Edition ($400 street, $200 upgrade) adds Paradox 9 and NetPerfect, an ingenious Web-publishing utility.

New conveniences in WordPerfect, Quattro Pro, and Presentations include a real-time preview that reformats a file on screen as you scroll through a list of fonts or experiment with colors and other graphics features. A redesigned graphics scrapbook lets you easily insert images, sounds, and videos from on-disk catalogs or the Web.

WordPerfect enhancements include an auto-scroll toolbar button that moves a document up or down the screen without requiring you to hold down a key or mouse button. Browser-style Next and Previous buttons (like those found in Microsoft Word) jump between pages, tables, graphics, and headers.

Although you can use WordPerfect for basic HTML creation and editing, you may find it more annoying than useful as a Web page editor. The default Web page template uses a gray background color, and the option to make a Web page display using a browser's default colors doesn't work. WordPerfect's unique markup-language editing tools now create XML files in addition to Standard Generalized Markup Language (SGML) files.



▶ **LESS IS MORE:** *CorelCentral gets the job done with a minimum of screen real estate.*

WORDPERFECT TO THE WISE

WordPerfect surpasses Word in its handling of multiple formats in the same document, complex multichapter documents, and booklet-style layouts. The optional Reveal Codes view looks archaic but allows unparalleled control over formatting. Amazingly, though, WordPerfect still can't search and replace font attributes.

The new Corel Quattro Pro adds a Web query tool that previews data pulled from remote HTML pages—a convenience not found in Excel. But Quattro Pro's crosstabs feature lacks Excel's wizard-based ease and in-place modifications of existing tables. A Formula Composer provides multiple views of complex formulas for ease in debugging. You can set Quattro Pro to use Excel or Lotus 1-2-3 file formats and menu layouts as the program's default, but when this option is chosen, many Quattro Pro features aren't available.

▲ **CROSS PURPOSES:** *Quattro Pro's crosstabs feature uses drag-and-drop buttons for designing reports.*

Corel Presentations imports and exports PowerPoint files and includes new bitmap tools to control brightness, contrast, and other image attributes. New graphics tools include flowchart-style shapes, and a wizard walks users through the process of creating a Web-based slide show. Paradox includes new wizards for building tables and queries.

The suite's biggest change is its slimmed-down CorelCentral PIM, a combined calendar, task list, and address book that slides off the screen when not in use. The address book displays both its own entries and those from the Windows address book, and it uses your default e-mail program to send messages.

Despite some minor first-release bugs (options such as Web backgrounds that don't work and arcane features such as screen-font controls that sometimes crash), Corel WordPerfect Office 2000 offers across-the-board improvements in speed, compatibility, and reliability. All current users will find the new version worth the upgrade price.

Corel WordPerfect Office 2000. Standard Edition, $300 street (upgrade, $100); Voice-Powered Edition, $350 (upgrade, $150); Professional Edition, $400 (upgrade, $200). Requires: 16MB RAM; 170MB hard disk space; Windows 95, 98, or NT 4.0. Corel Corp., Ottawa; 800-772-6735; *www.corel.com.*

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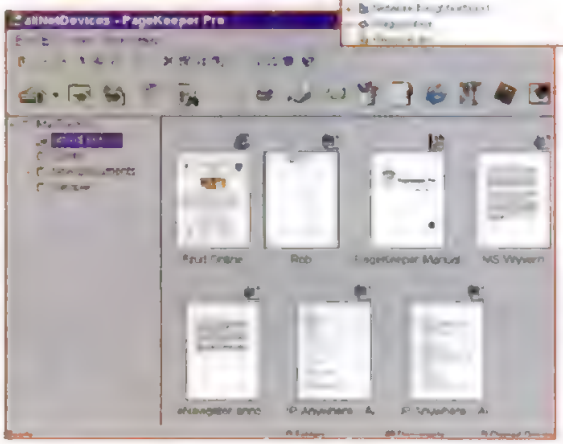
Information Overload

PageKeeper Pro 3.0 and Pagis Pro 3.0 offer unique document management strengths.

By David Haskin

Scanner prices are in the basement, the Web is everywhere, and we continue to churn out letters, memos, reports, and a slew of other documents—resulting in loads of data that you have to keep track of. The solution may be as simple as choosing a document management program such as the newly updated PageKeeper Pro 3.0 ($50 street), from Caere Corp., or Pagis Pro 3.0 Scanning Suite ($100 street), from ScanSoft.

Both programs provide folder-and-subfolder interfaces into which you scan and import documents and Web pages. In addition, they index documents so you can search their contents, provide control over the scanning process, and include top-shelf OCR. The program you select depends on your needs: We found that each excelled in a different area.



▶ ORGANIZE: *PageKeeper provides a clean folder-and-subfolder interface for categorizing documents.*

PAGEKEEPER PRO 3.0

PageKeeper Pro 3.0, which is included in Caere's recently introduced OmniPage Pro Scanning Suite ($149 direct), provides an elegant set of tools for automating the document management process, although it doesn't manage your scanner as well as Pagis Pro 3.0. PageKeeper conveniently indexes text documents when you scan them or add them from your hard disk so you can search through their contents immediately. By contrast, you can't search through new documents in Pagis until you update the index.

Caere has added two features that further automate the document management process. Folder Watch keeps track of Microsoft Windows directories that you designate, and it adds to PageKeeper the documents you are adding to those directories. A related feature, Smart Folders, examines documents added to PageKeeper for criteria, such as specific words in the text or file names. When it finds your criteria, the program places the document in the PageKeeper folder you specify.

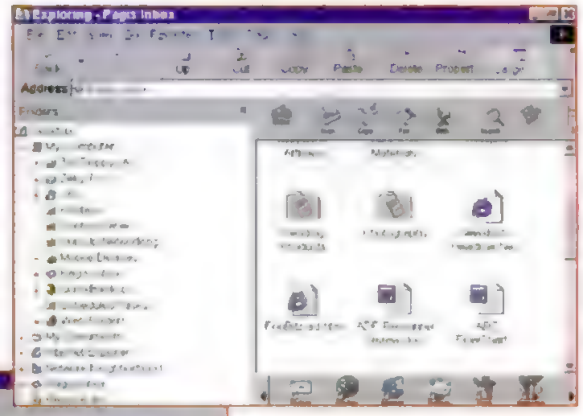
PageKeeper has solid search capabilities, which provide a relevancy-ranked list of found documents that meet your criteria. In addition, the software supports fuzzy searching, and you can access the search dialog box from the Find menu found by clicking on the Start button.

The program provides comparatively little control over your scanner, however. PageKeeper can't, for instance, print or fax scanned documents in a single step, as Pagis can. Nor can it convert documents from one format to another.

PageKeeper's accurate OCR engine is the same one used in Caere's OmniPage, but it isn't flexible. For instance, after scanning, you can open text documents with office applications, but PageKeeper won't maintain the original document's formatting.

PageKeeper Pro 3.0 is an elegant, inexpensive solution for those whose primary need is to collect documents and then find information within them.

PageKeeper Pro 3.0. Street price: $50. Requires: 32MB RAM; 90MB hard disk space; Windows 95, 98, NT 4.0 or later. Caere Corp., Los Gatos, CA; 800-535-7226; *www.caere.com.*



◀ INTEGRATED: *Pagis builds itself directly into Explorer, adding a couple of toolbars and thumbnails.*

PAGIS PRO 3.0 SCANNING SUITE

This program, from ScanSoft, excels at helping you get the most out of your scanner, but its document management tools aren't as automated or as flexible as PageKeeper's. For example, you must periodically update the index before you can search through new documents. In addition, Pagis can capture Web pages and store them in folders but doesn't index those pages.

You can also send a document directly to other applications after you scan it. When you send the document to a text-oriented application such as a word processor, Pagis uses the included TextBridge 9.0 OCR program to convert the document to text, maintaining the original document's formatting. The program also scans images directly into image-editing programs.

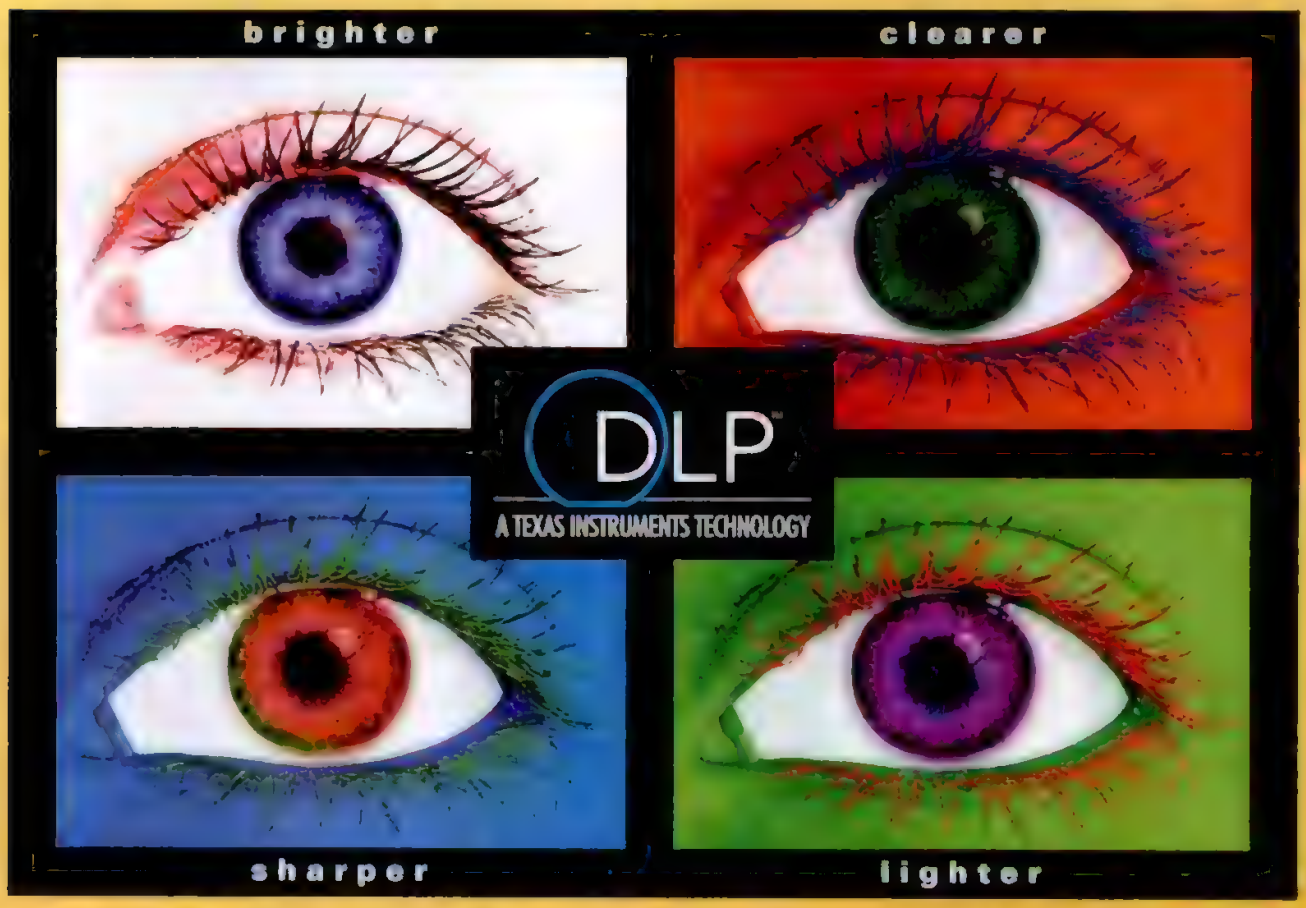
Pagis's search capabilities for documents it has indexed are slightly stronger than PageKeeper's. Like its competitor, Pagis provides a relevancy-ranked list of search results and supports fuzzy searches. In addition, the software can search for similar sounding words and derivations of words, such as the same verb in different tenses.

This program is full of conveniences. A new wizard for setting up your scanner is both thorough and simple. You can save scanned documents in any of 40 formats and convert documents among those formats easily. This is a suite that includes the Adobe Photo Deluxe Business Edition image editor and a forms-fill-in program that enables you to scan forms, fill them in, then print them out.

Pagis Pro 3.0 Scanning Suite is the best add-on to your scanner we've seen. It also has top-notch text search skills, but if you want true no-brainer document management capabilities, PageKeeper might be the better choice.

Pagis Pro 3.0 Scanning Suite. Street price: $100. Requires: 32MB RAM; 120MB hard disk space; Windows 95, 98, NT 4.0 or later. ScanSoft Inc., Peabody, MA; 800-584-6843; *www.scansoft.com.*

SEE THE DIGITAL DIFFERENCE.



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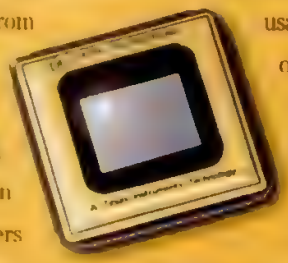

With its 100% digital design, DLP technology produces more usable light, achieving higher levels of brightness than other projection systems. And DLP technology's unique digital light displays 16.7 million digitally correct colors for brilliant, breathtaking images that will never degrade over time.

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- 15" (13.8" viewable) .28mm Monitor
- 4MB 3D AGP Graphics Accelerator Card
- 40X Max Variable IDE CD-ROM Drive
- Aureal Vortex A3D Wavetable Sound Card
- Tool-Free Mid Tower ATX Case with 235W Power Supply
- Logitech PS/2 Mouse
- Stereo Speakers
- Microsoft Windows 98 CD-ROM

Intel® Celeron™ processor 333MHz with 128KB Cache **$735**
Intel® Celeron™ processor 366MHz with 128KB Cache **$749**
Intel® Celeron™ processor 400MHz with 128KB Cache **$785**
Intel® Celeron™ processor 433MHz with 128KB Cache **$835**

CSS-5000 fileserver

- Dual Intel® Pentium III Xeon™ Processor 500-550MHz
- Intel® 440GX Chipset 100MHz with USB
- 128MB 100MHz SDRAM (Supports up to 2GB)
- Integrated Adaptec 7890 Ultra-2 SCSI Controller (80MB/s)
- Integrated RAIDport III
- 6 Expansion Slots
- 4 5GB Ultra-2/LVD SCSI Hard Disk Drive
- Trident 3D Image 9750 AGP Graphics Adapter w/4MB
- 40X Max Variable SCSI CD-ROM Drive
- Intel® Pro 100+ Ethernet Adapter

CSN-1500DVD notebook

- Intel® Pentium® II processor
- 15" XGA Active Matrix
- 64MB SDRAM (384MB Max)
- 6.4GB Ultra ATA Hard Disk Drive
- 2X Max Variable DVD-ROM & 3.5" Floppy Drive Combo
- MPEG II DVD Decoder Card
- 8MB 2X AGP ATI Rage Pro 3D Video 1025x768 24bit Color
- Internal 56K V.90 Fax Modem
- 3D Surround Sound with Speakers and Microphone
- Intelligent Lithium Ion Battery and AC Adapter

Look like a Web Pro

NetStudio 2000 helps you easily create fast, impressive graphics for Web pages.

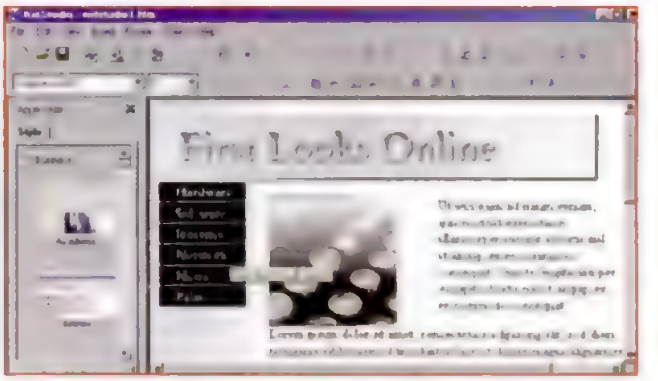
By Edward Mendelson

The Web graphics on your personal or small-business site don't have to look as though they were made with a cookie cutter. NetStudio 2000 ($90 street) lets anyone create professional-quality buttons, banners, logos, hover buttons, and other Web graphics, using an interface closely resembling that of Microsoft Office 2000. The package, from NetStudio Corp., is strong on graphics and text effects, but it lacks HTML and JavaScript features that convert those graphics into mouseover buttons and navigation bars.

NetStudio 2000's interface consists of a no-frills editing window next to a gallery of 51 graphics styles. You can create a Web image by answering questions in a wizard, or you can start with a blank window and create an image using toolbar icons.

Once you create a button and add or modify text, you can change its appearance by selecting a style from a gallery or by modifying its color, font, and other formatting from dialog boxes. Any style created in the editing window can be saved to the style gallery for future use.

The program's standout feature is its ease of use in applying effects to graphics and texts. For example, a click on a toolbar icon adds a shadow to an object in one step. To adjust the position, shading, or blur level of the shadow, you can open a dialog box from the top-line menu and use slider bars for fine-tuning.



▲ **BUILD BUTTONS:** *NetStudio 2000 creates the graphics, but you need separate software to make them link to other pages.*

You'll have to do some heavy labor in an HTML editor to make the graphics do more than just look good. For example, if you want to create a hover button that changes appearance when the mouse passes over it, NetStudio 2000 can build the graphics, but to make them function in a browser, you must code JavaScript by hand or insert the graphics in FrontPage's theme editor.

NetStudio 2000 works well as a graphics factory and excels in ease of use, but knowledgeable users may prefer Adobe's ImageStyler, which creates the images, JavaScript, and HTML code that make the images functional on a Web page.

NetStudio 2000. Street price: $90. Requires: 16MB RAM; 30MB hard disk space; Windows 95, 98, or NT 4.0 or later. NetStudio Corp., Mountain View, CA; 800-672-9559; *www.netstudio.com.*

Space-Saving Scanner

The Canon CanoScan FB 620U is appealing in all ways but one: its scanning performance.

By Daniel Grotta and Sally Wiener Grotta

The compact, curvy design of the Canon CanoScan FB 620U color flatbed scanner ($130 street) is downright cute. Unfortunately, despite the CanoScan's effortless setup, simple-to-master interface, and moderate USB performance, we were unable to produce an acceptable color photo scan.

The CanoScan is targeted for the nongraphics SOHO market. The unit is a 36-bit, 600-by-600 ppi scanner that uses CIS rather than CCD technology, which accounts for its ultrathin silhouette (2.3 by 10.0 by 14.5 inches, HWD) and weight of about 4 pounds.

Setup and software installation take about 10 minutes. Just unlock the shipping lever on the scanner's bottom, plug in the AC adapter (there's no on/off switch), and connect the enclosed USB cable to your computer. The scanner is a true plug-and-play device, and the Twain driver and bundled applications—PhotoDeluxe Home Edition 3.0, TextBridge Plus, and others—are a breeze to install. The disk-size documentation booklet gives you just enough information to get up and running.

Scanning couldn't be simpler. The CanoScan can easily be set up as a touch-and-scan device, so pressing the button in the front will automatically scan and send a fax, output an image to the Web, or make a copy that goes directly to your printer. The interface has all the standard tools—rotate, flip, and scale, among others—as well as a one-button color-correction feature. The CanoScan took a fast 44.8 seconds to scan our 200-ppi, 4.6- by 6.5-inch test photo—about midway between parallel and SCSI scanner performance.

▼ **TONY LOOKS:** *The Canon FB 620U CanoScan is great design in a very a small package.*

Unfortunately, the scanned test image was very dark and muddy. Viewing its histogram (a visual representation of data) showed that most of the midtones and all of the highlights were missing. Canon speculates that this was due to an obscure Microsoft Windows problem that may relate to color profiles not being recognized on some computers. But after testing two different CanoScan FB 620U models on four different PCs, we experienced identical, unacceptably poor results.

If not for the poor scanning quality, the CanoScan would be an excellent space-saving device. But until Canon solves its color and exposure problems, we cannot recommend it.

Canon CanoScan FB 620U. Street price: $130. Requires: 16MB RAM, 70MB hard disk space, USB port, Microsoft Windows 98. Canon Computer Systems Inc., Costa Mesa, CA; 800-652-2666; *www.canoscan.com.*

PHOTOGRAPHY BY THOM O'CONNOR

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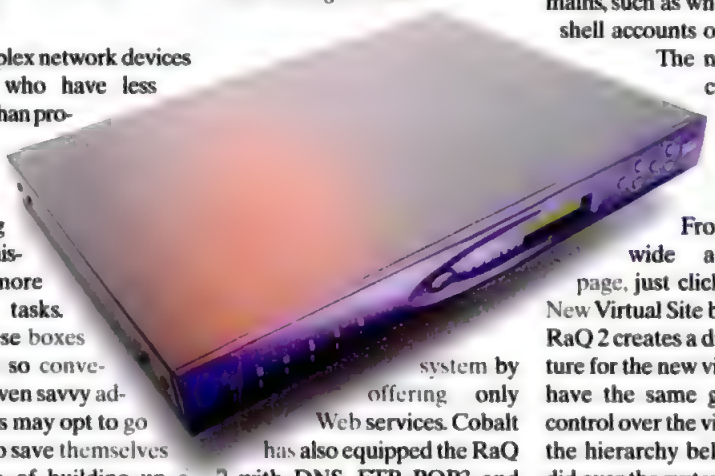
Simple Services for ISPs

The RaQ 2 uses small-business logic to bring easy-to-use Web services to the ISP.

By Russ Iwanchuk

Cobalt Networks has spawned another version of its popular Qube 2 (reviewed in "Slick Server Solutions," April 6, 1999): the newer, flatter, and more powerful Cobalt RaQ 2 (tested configuration, $1,599 list). Like the Qube, the RaQ 2 is a network server appliance that provides Web and other network services. But though the Qube 2 is well suited for the small to medium-size office, the RaQ 2 (and the RaQ before it) is designed specifically for ISPs and larger networks.

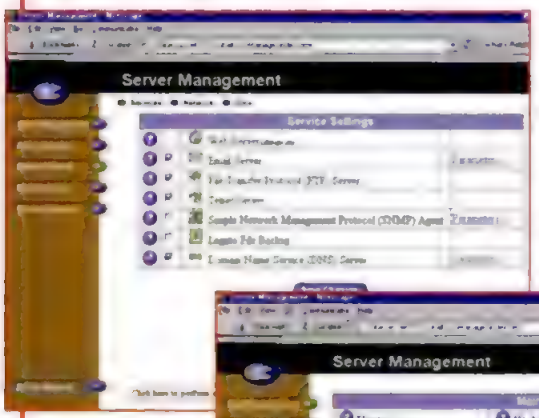
Network server appliance boxes seem to be all the rage these days, and Cobalt Networks is leading the pack. The appliance idea is a good one: Make a (usually) closed-box network device, hide the nitty-gritty details of the underlying free operating system from the user, provide a user-friendly interface, and sell it cheap. Network server appliances bring the administration of complex network devices to people who have less know-how than professional systems administrators, freeing these administrators for more pressing tasks. Rolling these boxes out can be so convenient that even savvy administrators may opt to go this route to save themselves the trouble of building up a Linux network server from scratch.



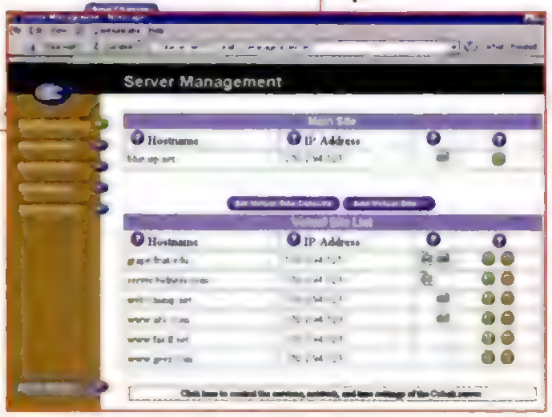
▼ **STYLE AND SUBSTANCE:** *The thin, rackable, blue RaQ 2 delivers a host of Internet and Web hosting services.*

LINUX AT THE CORE

The RaQ 2 was designed with ISP functionality in mind, and as such is ready to support multiple Web domains hosted at a single IP address (virtual domains)—up to 200 in one box. As in other Cobalt products, Linux (kernel 2.0.34) is at the heart of the RaQ 2, and Linux didn't get where it is today as a network operating system by offering only Web services. Cobalt has also equipped the RaQ 2 with DNS, FTP, POP3 and IMAP4, SMTP, and telnet. Each service is configurable through the excellent Web interface to the level of a virtual domain. Of course, if you are Linux-savvy and want more functionality out of the RaQ 2, you can telnet in and tweak to your heart's content. (But beware: Changing your system files may affect your warranty.) The RaQ 2 offers CGI and Perl script support to take your customers past simple static pages.



◀ **IN CONTROL:** *A system administrator can use the Control Panel to turn systemwide services on and off, as well as configure other connectivity and virtual domain options.*



▶ **BUILD IT:** *Through the Server Management screen, the system administrator sets up virtual domains and systemwide policies.*

PHOTOGRAPHY BY THOM O'CONNOR

VIRTUAL DOMAIN SETUP

Setting up the RaQ 2 to host multiple Web domains is intuitive and simple. Assuming the rest of the network infrastructure is in place (a reasonable assumption for an ISP), you can go from out-of-the-box to hosting a couple of virtual domains in about 15 minutes.

As with other Cobalt products, the first step is to enter networking information, such as IP, DNS, and gateway settings, using the LCD screen on the appliance. Once the box has an IP address, you point a Web browser to it, log on as the administrator, and configure systemwide settings, like host name and domain name. You can also enter other systemwide settings that will be enforced for virtual domains, such as whether to allow shell accounts or CGI scripts.

The next step is to create whatever virtual domains customers require. From the systemwide administration page, just click on the Add New Virtual Site button and the RaQ 2 creates a directory structure for the new virtual site. You have the same granularity of control over the virtual site (and the hierarchy below it) as you did over the system in the previous step.

Finally, RaQ 2 administrators will want to create a user with administration rights to the new domain so that they can pass responsibility for the site and its users to the customer. Once the customer/administrator takes the reins, he or she can create user accounts in the virtual domain, back up or restore pages, and check usage reports and Web activity on disk. Users can then FTP to the virtual domain to upload Web pages.

MANY OPTIONS

The RaQ 2 we tested was configured with 32MB of RAM, a 3.2GB hard disk, two fast Ethernet ports, and a SCSI port. Cobalt offers a range of configuration options: 16MB to 256MB of RAM, up to 16.8GB of hard disk space, and the choice of having only one Ethernet port and no SCSI port. All RaQ 2 configurations use the same 19-inch rackable 1U chassis.

ISP and enterprise administrators looking for a quick-deploying server for hosting multiple Web sites should find the RaQ 2 an excellent choice.

Cobalt RaQ 2. List price (tested configuration): $1,599. Cobalt Networks Inc., Mountain View, CA; 650-930-2500; *www.cobaltnet.com.*

Serve Your Small Office

The HP NetServer E60 provides small businesses with power and other computing essentials.

By Steve Rigney

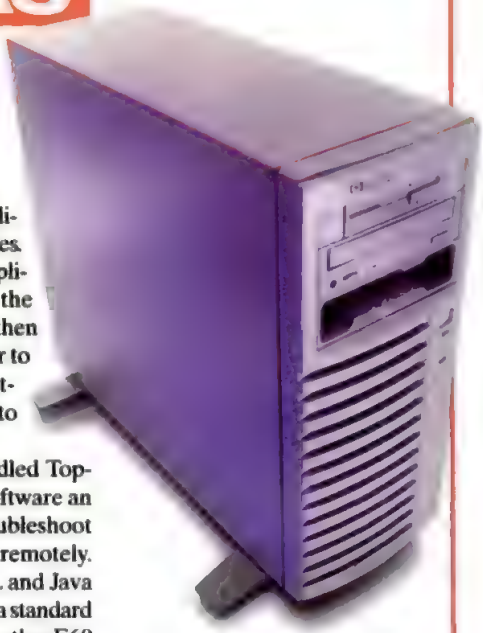
Many small businesses need the same powerful servers as their larger counterparts but often cannot afford them. For a time, PC vendors marketed workgroup and departmental servers to fill this gap, but at prices intended for larger corporations. Now new products like the HP NetServer E60 (tested configuration, $3,130 street) are entering the arena.

The E60 starts at about $1,500 with a 400-MHz Pentium II processor and 64MB of RAM. Our dual-processor-capable test machine included a single 500-MHz Pentium III CPU, 128MB of RAM, a 9GB SCSI hard disk, and an HP SureStore T20Xi tape drive. Every model also includes a built-in 10/100 Ethernet adapter, five PCI slots and one ISA slot, as well as four internal drive bays. Our test unit included Windows NT Server 4.0, but you can order the E60 with different versions of NetWare, SCO Unix, and Linux.

System documentation is online and easily accessible from the Info Assistant icon on the desktop. Because our unit came with a tape drive, the backup software was preinstalled, and icons were placed on the NT desktop along with a folder for the TopTools management console.

As firm believers in data protection, we were glad to see the bundled SureStore T20Xi Travan drive. It can hold 10GB of uncompressed data and 20GB using compression.

Also bundled was a single server copy of Stac Replica. Replica backs up the entire server volume, not individual files or directories. To restore files via Replica, we had to mount the tape as a volume and then use Windows Explorer to copy the files we wanted to retrieve back onto the hard disk.



ALL IN ONE: *The E60 has the tools you'll need to set up and maintain a small network.*

We found the bundled TopTools management software an excellent way to troubleshoot the E60 locally and remotely. TopTools uses HTML and Java applets, so you can use a standard browser to check on the E60 from any location. With TopTools, we were able to check the health of our server, monitor network performance, view alerts, and create a network topology.

The E60 is a powerful server, but with a price clearly intended for smaller businesses. Best of all, HP didn't forget the other features that a small business needs—they're all in the box. **HP NetServer E60.** Street price (tested configuration): $3,130. Hewlett Packard Co., Palo Alto, CA; 800-752-0900; 650-857-1501; *www.hp.com*.

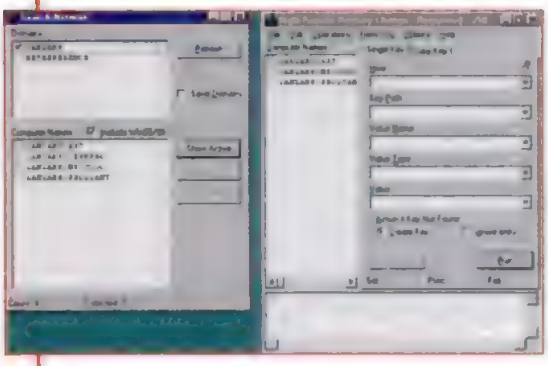
A Flexible Registry Editor

Multi-Remote Registry Change lets you perform Registry changes you can't do with Regedit32.

By Steve Rigney

Microsoft would like you to believe that you rarely have to edit the Windows Registry and its arcane listing of keys and values. In reality, network administrators are all too aware that the Registry can be troublesome and may require changes. Both 9*x* and NT 4.*x* versions of Windows include tools for editing the Registry (most notably the NT utility Regedit32), but they lack the variety of functions that many administrators need.

Eytcheson Software has come up with a Windows NT registry tool that can edit multiple remote NT registries at once, thus saving administrators countless hours. Multi-Remote Registry Change 3.0 ($35 per administrator, $2 per PC) does not offer many more features than Regedit32, but the added ability to edit multiple registries simultaneously will be worth the purchase price for many.



MORE OPTIONS: *Unlike Regedit32, Multi-Remote includes scripts that simplify changing a user name and password on multiple PCs at once.*

Multi-Remote is available for download (*www.eytcheson.com*). The entire program, complete with a separate help file, is only about 2MB. The product is a snap to install and runs on any Windows NT 4.*x* or later server. You pay only for the client PC licenses—there is no additional client element to install. As a test, we installed Multi-Remote on a PC running Windows 2000 Beta 3 and found no problems.

Multi-Remote does not have the same Explorer-like look as Regedit32, but the interface is straightforward, and we actually found it easier to use. For example, Regedit32 puts the Value Name, Value Type, and Value Key settings in the same text line, while Multi-Remote provides a separate box for each piece of information.

When we first launched Multi-Remote, it automatically listed our Windows NT domains and allowed us to select the NT PCs we wanted to include. By default, Multi-Remote shows only the NT servers on the network. (You can choose to list Windows 9*x* PCs, but Multi-Remote will not edit those registries.) After we selected the NT PCs to add, we were able to select each registry or select multiple PCs to edit simultaneously.

One of the tests we performed was changing the home pages for the Netscape browsers on all of our NT PCs without touching their keyboards. We could also change user names, time settings, and scheduled operations.

Only administrators with many NT PCs will truly be able to take advantage of the product. That said, this one-trick pony performs a helpful and unique trick. **Multi-Remote Registry Change 3.0.** List price: $35 per administrator, $2 per NT PC. Eytcheson Software, Independence, KS; 316-332-4604; *www.eytcheson.com*.

PHOTOGRAPH BY THOM O'CONNOR

ThinkPad® 570

the new thinkpad 570.(dramatization)

transformer	This is how it works. Slip the ultralight, superthin ThinkPad 570 into an UltraBase and it transforms into an all-in-one desktop ready for the office or the road. ibm.com/thinkpad 800 426 7255, ext. 4203
ultrabase	holds floppy drive or extra battery and options like CD, DVD, Zip, extra hard drive[1] or SuperDisk LS-120
notebook	1" thin[2] / 4.0 lbs[2] / 12.1" or 13.3" active matrix display 4.0gb or 6.4gb hard drive / 64 - 192mb sdram mobile Pentium® II processor 300PE / 333 / 366 mhz
price	from $2,699[1]

intel inside
pentium® II

[1]Estimated reseller price for model 570/2AU. Price excludes UltraBase and other options. FDD/battery included. Actual prices may vary. [2]Actual weight/thinness may vary due to vendor components, manufacturing process and options. Weight includes battery; excludes FDD and other options. [1]Adapter required. mhz denotes microprocessor internal clock speed only; other factors may also affect application performance. gb=1 billion bytes for HDD capacity. PCs referred to in this ad include an operating system. IBM product names are trademarks of International Business Machines Corporation. The Intel Inside logo and Pentium are registered trademarks of Intel Corporation. © 1999 IBM Corp. All rights reserved.

e-business tools

Faster Office Wireless

The RadioLAN Mobilink 140 trades standards for reliability, ease of use, and performance.

By Jeffrey Witt

With the abundance of wireless products hitting the market, potential customers have a wide range of choices. Few competitors offer performance levels of traditional wired Ethernet networks, however. RadioLAN's newest Type II PC Card offering, the Mobilink 140 ($499 list), has joined its 10-Mbps wireless family of products, providing ease, speed, and manageability for roving notebook users.

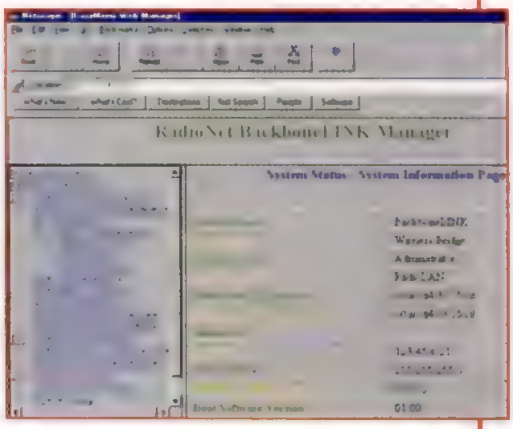
The Mobilink 140 boasts a one-piece design; its attached radio transceiver is about the size of a StarTrek Tricorder. The unit is lightweight, and the transceiver can be angled well out of the way of your hands. The signal covers a 120-foot radius inside and up to 300 feet in open space.

Differing from its competitors, RadioLAN is using the 5.8-GHz frequency band. The more commonly used 2.4 GHz risks potential interference from devices such as microwave ovens and cordless telephones. And although the competition has focused on good-enough 1-Mbps and 2-Mbps wireless standards, RadioLAN has instead chosen to concentrate on wired Ethernet compatibility.

To attach to your Ethernet network you'll need the BackboneLink 208 access point ($999 list). This small device (about the size of a desktop modem) includes a port for attaching to your hub and a two-pole antenna. We installed the system on our test network and had instant connectivity to our Windows NT server.

RadioLAN uses its own 10-BaseRadio protocol to enable the wireless components to speak to one another, while at the same time supporting common network protocols. We time-tested several file transfers of various sizes, compared them with a wired client on the network, and found no appreciable difference.

The Mobilink 140 ships with RadioNET Manager, a Windows-based utility that allows monitoring of your link, diagnostics, and performance statistics. BackboneLink has a built-in HTTP interface that lets you use RadioNET Manager from anywhere inside your network via a browser. You can also use RadioNET Manager's SNMP link with BackboneLink. Security comes in the form of SecureLink RSA encryption.



▶ **USE THE WEB:** *Built-in HTTP lets you manage your wireless network from anywhere on the traditional network via a browser.*

We experienced some problems with additional software. We were not able to get the included IP Assign utility to specify a valid IP address to the BackboneLink access point, so we resorted to using a direct serial cable link and the terminal console.

For companies looking for a wireless solution that competes on both cost and robust performance, RadioLAN hits the mark. **RadioLAN Mobilink 140.** List price: $499. **BackboneLink 208.** List price: $999. RadioLAN Inc., Sunnyvale, CA; 408-616-6300; *www.radiolan.com.*

Shared Storage Is a Snap

The latest version of the Snap! Server is just the NAS solution the small business ordered.

By Craig Ellison

Meridian Data has revamped its popular network attached storage (NAS) appliance and come up with the Snap! Server 2.0. The faster processor, larger hard disk capacity, and new software features have added to its ease of use and installation and its functionality.

The unit is available in either a single-drive configuration (8GB) or in a dual-drive configuration (either 16GB or 32GB drives). We took a look at the 16GB version ($1,795 list).

The Snap! Server is appropriately named. If your network automatically assigns TCP/IP addresses, all you have to do is plug it in to your 10/100-Mbps Ethernet network, plug the power cord into the wall, and turn the device on. By default, AppleTalk, HTTP, IPX, NetBeui, NFS, and TCP/IP are supported and turned on. A supplied utility called Snap! Assist enables you to determine or assign the IP address of your server. Once you have the IP address, you can configure the system through the built-in Web browser interface.

The Snap! Server's most important new feature is native Macintosh support. Since Macs generally create very large files, a Snap! Server is a great solution for sharing online archives in mixed environments. When you plug the unit into your network, your Macs will see it in their Chooser. In workgroups where Macs and PCs have to share files, The Snap! Server requires no additional configuration to get up and running.

▲ **CLOSED BOX:** *The same small chassis surrounds both the single-drive and dual-drive configurations.*

Other new features include support for RAID Levels 0 and 1. We configured our test unit for RAID 0 to combine the two 16GB disks into a single 32GB volume. For valuable data, RAID 1 provides the additional fault tolerance.

Meridian Data has also lowered the price of the Snap! Server line. For $999, you can purchase the 8GB model; the 32GB model is $2,495. Existing 1.X Snap! Server owners can download the new 2.0 code for free *(www.snapserver.com/download/index.html)* to upgrade to the new set of features.

Either from an ease-of-use and installation standpoint or from a cost-per-megabyte perspective, the Meridian Data Snap! Server2.0 is an ideal solution for workgroup shared storage.

Meridian Data Snap! Server 2.0. (16GB model). List price: $1,795. Meridian Data Inc., Scotts Valley, CA; 888-343-7627; *www.snapserver.com.*

PHOTOGRAPHY BY THOM O'CONNOR

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The new VP150, 15" viewable LCD ViewPanel® is a case in point. It features a 140° viewing angle, a spectacular true resolution of 1,024 x 768, a rock solid image and amazing screen performance. Put the ViewSonic VP150 on top of your priority list and enjoy the best in Display Technology™.

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*Stanford Resources Quarterly Monitrak report Q4 '98 and Display Search Quarterly Supply vs. Demand study: LCD Monitors Q1 '99.

The G3's a Winner

By Troy Dreier

We asked for comments on the new blue-and-white Apple Power Macintosh G3, and readers responded in droves. Many thanks to all, as well as to *MacAddict* magazine for throwing us a link that brought in many experienced users. After sifting through the responses, we saw that G3 users are able to look with clear eyes at the system's groundbreaking improvements and mystifying shortcomings.

Most of the conclusions from our original review were confirmed ("Reinventing the Power Mac," April 20, 1999). The G3's revolutionary side-access design, for example, was lauded. As one reader said: "The easy-open design made it a snap to add RAM and a SCSI card. How refreshing—and sobering—when you consider how long it took for somebody to think of it."

Not only did these flashy systems satisfy the faithful, but they also won a few converts. Another reader told about the OS war in his own home: "I bought a 400-MHz blue-and-white G3, and my wife used her Gateway. We had lots of teasing about whose machine was superior. That stopped when she actually sat down and watched me working on mine. The Gateway went to a local charity."

Not everything about the G3s tickled our readers. The main drawback, as we noted in our review, is the lack of access to older peripherals and components. Sure, you can buy adapters to use SCSI hardware, but should you have to?

A HIT: *The Mac G3 even won a few converts.*

The lack of removable storage was also a big problem. One reader explained the dilemma well: "If Apple is ready to assert that the floppy disk is dead, I still believe that it had better offer up an alternative first." Adding a built-in Iomega Zip Drive or Imation SuperDisk would have been a giant improvement.

We saw some criticism of the G3's petite keyboard and mouse. "The new mouse is just terrible. If I had a tiger paw on the other side of my wrist, it might be tolerable, but for my human hand (a large one at that), the new mouse is too short and too wide," said a reader.

Finally, there was a wallet-conscious posting that any Mac user would second. "They're great machines," wrote a reader, "but I wish they were cheaper."

AMD Works for Many

By Carol Venezia

Our discussion of the viability of AMD processors versus Intel Pentiums clearly showed that lots of people out there are pleased with their AMD-powered PCs. One sentiment that was expressed by numerous folks: The applications they use every day run just fine on AMD machines. But more important, they see no need to spend the extra money on Pentium II or Pentium III PCs.

There are many people out there who are taking the money that they're saving on AMD machines and putting it to good use. One reader had the right idea: "The money I saved by going with AMD, I spent on extra RAM and a 3-D card." In fact, if you check out *PC Magazine*'s "The Ultimate Upgrade Guide" (March 9, 1999) you'll find our tips and tricks on how to get the most bang for your PC buck.

3-D performance on AMD PCs compared with Intel-based computers was also a big topic of discussion. Early on, one of our participants pointed out that the AMD K6-III lags behind both Pentium II and Pentium III on floating-point operations. And our tests have verified this observation.

But many other readers just didn't seem to care; they affirmed that their AMD machines are perfectly capable performers—both on business applications and on games. And although some mentioned that hard-core gamers should probably go the Intel route, one gentleman suggested, "If you're a gamer like me, and you want a low-cost processor while also having the freedom to upgrade, skip Celeron and buy an AMD K6-III."

The very few pro-Intel participants in our discussion brought out an important point: If you want multiprocessor support, right now AMD has nothing; you have to buy Intel. But that's going to change in the very near future, when AMD ships its much anticipated K7 chip (expected sometime this summer).

All in all, however, there are lots of you who own AMD machines and are very happy with them—because the PC that fits within your budget and does what you want it to do is the right PC for you. As one participant aptly puts it, "Everyone worries about minor differences in processor power, when in the real world it makes very little perceptible difference to the average user." Well said.

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Tell us what you think... How do you like the new products you're using? Second Looks is your forum for feedback. Join us online to tell us about your experiences. We discuss a different new product every week and summarize your comments here. Following are some of your comments from our discussion of the Apple Macintosh G3.

The G3/400 is an absolute powerhouse *and a work of art to boot. I will soon have one of the new Yosemite G3s at home as well, because I, like many others, have started to realize that the new Macs are truly indispensable workhorses that just keep on going, whereas Windows lets me down far too often.*

—Jeff Manus

I use a PC for most of my presentations *and almost everything that requires Microsoft software, but the Macintosh is the best for creating images and other graphics. The mouse is more precise and responsive, and the keyboard is more logically laid out. My office has both fast PCs and new G3s. I have to say that the G3 really rocks!*

—David Ashford

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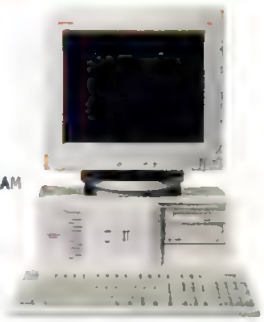

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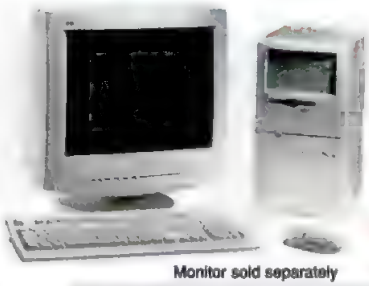

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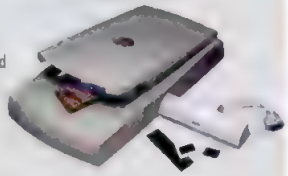

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Web Success Formula

My column "Too Big for the Little Guys?" (June 8, 1999) dealt with two Web sites I was familiar with—one that had achieved enough success to be self-sustaining and another still striving to turn the corner. I invited readers to share their own discoveries of little sites, those treasures of special interests and private passions, and was rewarded with a cornucopia of delightful sites. I can't list them all, but here are some that I enjoyed along with a few thoughts on how successes are made.

Car sites are plentiful, some so specific that they focus on given makes, models, and even years. One of the better ones is *www.a4.org*, for Audi A4 owners. It's a lively, informative site, with lots of participation and a great FAQ.

My wife, the avid reader, knew all about *www.mysteryguide.com*, which Tim Converse supports via his consulting business. He's getting 60,000 page views per month, yet the site remains invisible to advertisers that should be looking for targeted, special-interest opportunities such as this.

How about *www.webmath.com*, which has been extensively programmed to help students with their math homework—in real time? You type in a problem and the site solves it while showing you the step-by-step solution.

Then there's the About.com phenomenon. Founded as The Mining Company, it's a federation of special-interest sites. According to Durant Imboden, the author of what has become the premier visitors' site for Venice, Italy (*goeurope.about.com*), some of the site owner/authors are making six-figure incomes from their pages. Among the most successful sites are Mark Twain, Southern U.S. Cuisine, and Video Game Strategies. The company offers stock options to its guides, who are essentially freelance writers.

Jim Salmons and Timlynn Babitsky, North Carolina–based consultants, have coined the term *nanocorp* to reflect their thinking about purposely small corporations. "A nanocorp is a ruthlessly small, revolutionary small business," writes Salmons. "Its founding owners are forever its only employees. The nanocorp's mission is to optimize the quality of life for its owners/employees. We are not about getting rich nor going public, although those 'side-effects' are not ruled out. We are, after all, guerrilla capitalists." Check out the home page's warning at *www.sohodojo.com*.

I hadn't heard of Sohodojo, but I had come across The Small Business Advisor (*www.isquare.com*) several times. Owner Bob Sullivan says, "The Small Business Advisor has grown in traffic to the point where we became attractive to a number of large businesses that are interested in marketing to the small-business community."

Sullivan adds, "You don't need to become an Amazon.com or eBay through an IPO to have a great Internet-based business with significant revenue possibilities. Simply take advantage of what you know, define your target audience, and go after them with good, useful, and current information."

No column of mine would be complete without a music reference, and you can't get more specific than the Telecaster Discussion Page Reissue, *www.tdpri.com*. TDPRI members talk about just one model of Fender guitar, but they discuss everything from identifying and dating old ones to recreating and modifying new ones from aftermarket and replica parts. The current owner of the forum, Paul Green, pays all the bills, but he sees upside potential in postings that total over 1,000 messages a day and 75,000 raw hits per week.

How about a site that addresses the resurgence of interest in Super 8 filmmaking? Michael Nyberg has a worldwide audience at *www.geocities.com/colosseum/1522/my_super8_0.html*. Aspiring directors can get surprisingly good quality at cut-rate prices with supposedly long-dead Super 8 equipment, but as you can imagine, it takes a lot of networking to locate, refurbish, and properly use the equipment.

All of these sites feature highly self-selected audiences with, in most cases, very similar demographic and psychographic profiles. This is a gift to the advertiser savvy enough to recognize an affinity group and willing to pay targeted ad rates instead of bulk rates. Targeted advertising and sponsorship would make a world of difference to the fiscal health of many of these sites..

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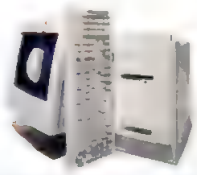

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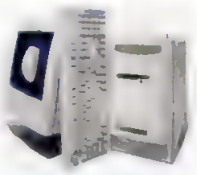

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John C. Dvorak

The Hacker Ethic

I'm sitting here downloading some files over a 1-Mbps DSL connection while my two sons are using the same line to accumulate booty on Ultima Online. We all seem to be operating at full tilt. Such is the unusual architecture of TCP/IP. Few users who aren't into networking or WANs appreciate this marvelous protocol and its ability to multitask without apparent performance degradation. But TCP/IP and many other Internet-related systems have security holes that concern individuals and businesses alike.

The hackers who attack systems because of these flaws have been lionized as heroes, because they've shown us that our computers aren't safe. I would like to announce to these folks that I am aware of this safety factor, and I do not need constant reminding. Exactly how the computer hacker (actually a computer *cracker,* in more accurate parlance) became a folk hero is one of the most interesting sociological phenomena that this country has ever encountered.

The irony is that these guys have become a menace and nobody has recognized it. Today's rogue computer hackers contribute nothing to society and prove nothing to anyone. They're following in the footsteps of guys who had a point to make, and now that point has been made to excess. Computer systems open to the outside world are not secure, okay? Been there, done that. It's boring.

If I leave my door open at night and someone roams in and messes up the place, I don't need an expert in the form of a burglar to tell me that I've virtually invited the person to do this. I invited nobody to do this. I trusted that they wouldn't. People who live in areas where they leave their doors unlocked like to brag about it. "I don't worry about people breaking in. We trust each other." Does this notion elude computer hackers, who break in simply because they can?

Right about now someone is thinking that my self-centered vision has little to do with the reality of the global marketplace. Russian spies can hack Department of Defense computers, and these hackers are providing a service in the national interest. I wonder how that logic sits with a guy who's trying to run an IRC server as he fights off endless denial-of-service attacks dealt by giggling goofball kids who downloaded the attack program from the Web.

There's no doubt that important systems need to be protected, and security flaws in those systems should be resolved. But there are talented professional hackers doing that as we speak. Yes, there's always the likelihood that some chink in the armor won't be discovered by the pros, and a rogue hacker needs to be out there to "finish the job." It sounds so neat and packaged. Yes, he's doing the world a favor by pointing out that he can do what nobody else can. He's also showing off to his pals.

A thief who picks my locks to go through my underwear drawer (Heaven forbid!) is not much different. Those defending the hacker ethos would say it's less like burglary and more like mountain climbing. They climb a mountain because the mountain is there. They hack machines because they're there. They don't damage anything; they hack and leave. Ha! A few hackers just crack and go. They are the noble hackers. But look around: The not-so-noble hackers are attacking servers. They're stealing data. They're nosing around systems, spying.

How many of you look for Trojan horses on your systems? There are dozens of them floating around, the most popular being some code called Back Orifice. When you're online, the horse unlocks your machine and announces its availability to the hacker. The next thing you know some guy is on your machine.

Many attacks on big installations are launched from the machines of naive users on TCP/IP connections. Someone will hack a machine and use it as a base to attack scarier machines, such as government computers. If anyone tracks down the source, they find a computer in a dentist's office.

There's nothing good or noble about these Trojan horses or the people who use them. Eventually people will get on the systems of individual users, hack their online banking, and transfer money to themselves. Make no mistake about it, what appear to be harmless pranks today will be serious crimes tomorrow. As more and more people are adversely affected by these guys, the sympathy for them will fade to oblivion. The sooner the better.

Computer systems open to the outside world are not secure, okay? Been there, done that. It's boring.

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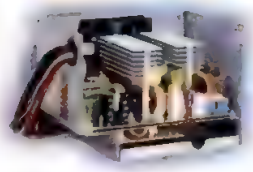

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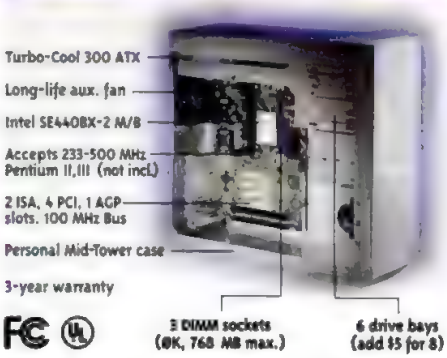

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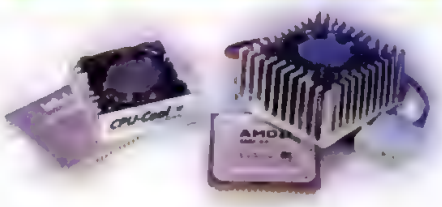

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John C. Dvorak's

INSIDE TRACK

Oops, We're Sorry Dept.: It seems that Intel has managed to keep away from the **antitrust quagmire,** unlike stubborn Microsoft. But Intel still **can't stay out of court.** One of the situations that got Intel in trouble in the first place—the dispute over an Intergraph patent—is still in the news, and Intel isn't winning.

As of this writing, Intel is arguing that this so-called clipper patent was part of a National Semiconductor portfolio, because National bought out Fairchild Semiconductor, and it was originally a Fairchild patent. Apparently the patent was sold to Intergraph as a separate deal, and National doesn't legally have it in the portfolio and can't share it with Intel. For those out there who know their history, **the irony of all this** is that Robert Noyce and Gordon Moore bailed from Fairchild to start Intel, supposedly with technologies that arguably should have stayed at Fairchild.

Fairchild was going to sue Intel in those days, but the story goes that William Shockley (of Shockley Transistor) announced that if Fairchild sued Intel **he'd sue Fairchild,** because the technologies that started Fairchild came from him! It's possible that someone with a long memory set up this interesting Intergraph/Fairchild/Intel irony. **Final revenge.**

It's possible that someone with a long memory set up this interesting Intergraph/Fairchild Semiconductor/ Intel irony. Final revenge.

When I was in college, I worked at Fairchild for a while. This was when the company used to grow silicon crystals; this dates me, and I hate mentioning it. Back then, there were groups of women who operated the **crystal-growing apparatus,** and nobody quite knew how or why one person could do the job better than another. It was considered a black art.

The silicon crystals then were maybe 1 inch in diameter and 1 foot long, unlike today's, which are up to 12 inches in diameter and of various lengths. My job was basically to watch over the operation at night. I'll never forget my **main instructions** from the honcho running the facility. He pulled a crystal out of his drawer and said, "These crystals are worth $1,000 each. Your job is to never tell those women that fact!" This gave me my first insight into the semiconductor business.

What's the Big Deal? Dept.: Microsoft is worried about a bunch of newcomers in the real-time OS business. The company intends to produce a real-time OS for Windows CE **code-named Cedar.** For those of you who are unfamiliar with this type of operating system, it differs from a typical OS in that it actually does things at an exact moment in real time.

A real-time OS is what's used to run a refinery. At 12:15:05 the A-30 pump has to be turned on, and at 12:16:44 it has to be turned off—**or the place blows up.** The process can't be interrupted by hard disk activity or incoming e-mail messages. Business computing does not need this kind of capability. Home computing doesn't need it. Even an Internet-enabled refrigerator that orders milk for you does not need it. Cars that drive themselves will require such an OS, but I don't see self-driving cars in the mass market anytime soon.

This brings me to the question of the week. Can anyone figure out **why Microsoft is bothering with this scene?** If you can, maybe you'd like to join the second iteration of a Delphi group I started about 15 years ago. It's interesting to try to **predict the future.** I'm now in the process of analyzing the old predictions to see what remained just a prediction and what actually happened. I'm also trying to determine what influenced the predictions and how those factors could be eliminated. Send e-mail with your bio to *delphi@dvorak.org* if you want to be in Delphi2000. You'll get a first look at some of the original results of these efforts.

Speed Record Dept.: Normally I don't write about such things, but **I was impressed** by the recent announcement that France Telecom hit a **data transmission speed of 1 terabit per second** over a 1,000-km length of optical fiber. This is a massive amount of data. This information was presented at the Optical Fiber Communication Conference a few months ago in San Diego.

This technology apparently uses **something called a solitron pulse.** A so-called solitron is a chunk of light that can maintain a fixed shape over a long distance. Until I read about this, I didn't know there was even a problem that needed solving. I'm also **amused** by this announcement, because getting a decent 56-Kbps modem connection in France is quite difficult. But terabits? No problem. Gee, thanks.

Genuinely Interesting Hardware Dept.: Looking to upgrade that CD-ROM drive in your old machine? Kenwood is showing a 52X true-speed drive in the TrueX line, which uses a multiple-beam technology developed by Zen Research. I've been playing with this thing, and it's noticeably fast—needless to say. **It smokes, in fact.** The thing sells for about $129.95 at CompUSA and elsewhere; check it out at *www.kenwoodtech.com.*

More Genuinely Interesting Hardware Dept.: Kenwood is known for shortwave radio gear as well as home stereo equipment. I'm reminded of an unusual piece of shortwave gear a friend of mine has been experimenting with called **the RX-320 PC Radio.** It comes from a small company in Tennessee called Ten-Tec (423-453-7172, *www.tentec.com*). It works with a computer and utilizes the CPU to do a lot of work, thus giving you a load of features for less money than you'd expect to pay for a more expensive rig. More interesting is the fact that the receiver is **field-upgradable** with a download! It costs around $300. Later this year, the company is going to bring out a PC-based transceiver called the Pegasus. Worth looking into. PC

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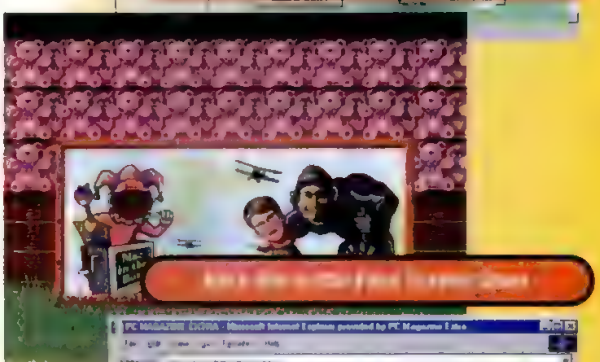

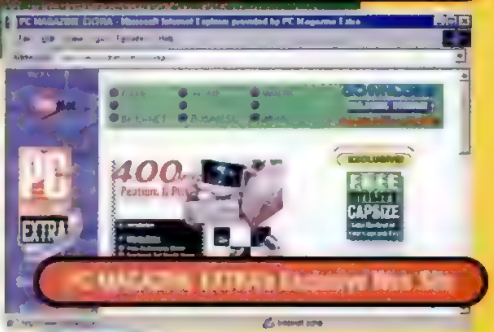

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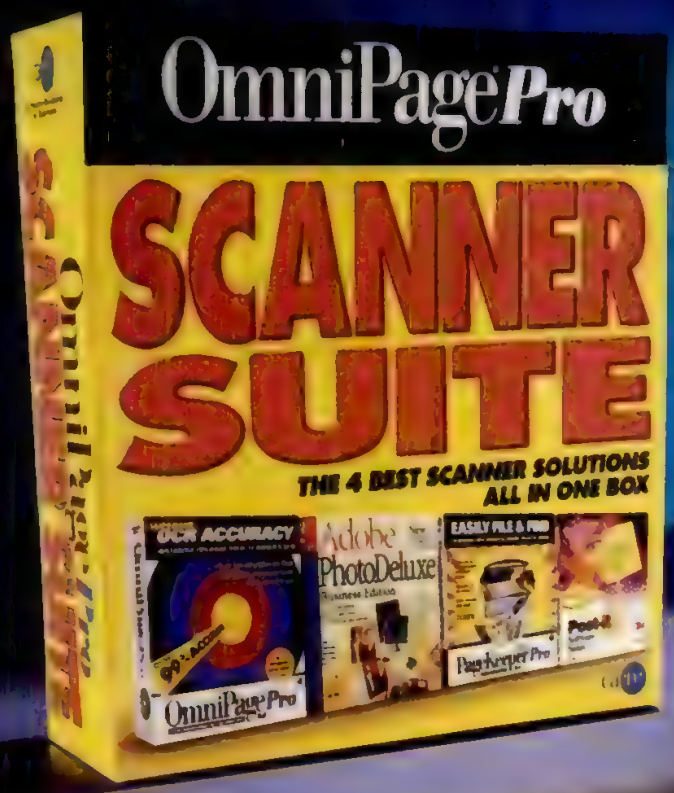

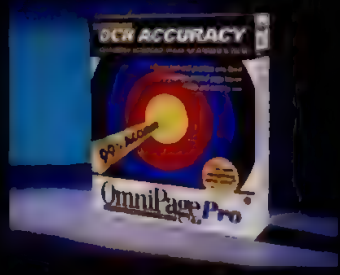

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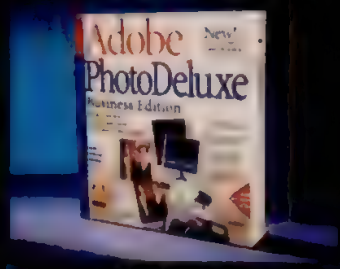

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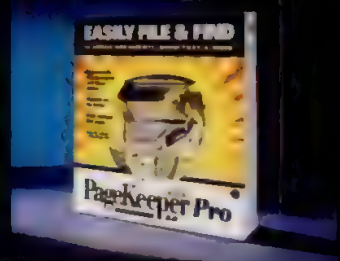

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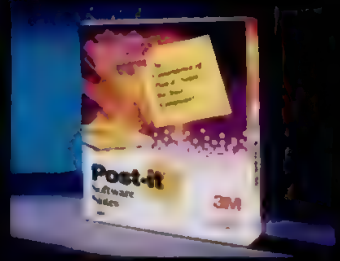

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Jim Seymour

Y2K Report: Better, But...

When I wrote here about Y2K worries last year and again earlier this year, I promised a midyear update on how things are going. The short answer: Things look generally better than they did then, and it's becoming pretty clear that—excepting the possibility of a Y2K-induced recession—forecasts of large-scale, long-lasting, nationwide problems can be discounted. This doesn't mean that there won't be scattered problems; that they won't affect you, your company, and your family; or that some of those problems won't be serious. Some almost certainly will be.

But on the whole, consciousness about Y2K has been raised to a level sufficient to avoid most problems and to deal effectively with many of the remaining ones.

Until now, I've dealt here mainly with PC issues, such as BIOS and RTC (real-time clock) problems in PC hardware and software compliance. This is, after all, *PC Magazine*, so our focus is determinedly PC-centric. Most of the really pernicious computer-related Y2K problems, however, have been in older, larger systems, all the way back to COBOL code written 20 and 30 years ago for now-aging mainframes.

And it's time, I think, to shift from a focus on our computers and software to the larger societal issues with Y2K. It doesn't much matter whether your PC is working properly if you can't get to work because of fouled-up train switches, out-of-order traffic lights, shut-down public transit systems, no electric or phone service, or inoperable elevators. It will matter a very great deal whether you and your family, friends, neighbors, and coworkers have potable water, food, or heat on that key turn-of-the-millennium, winter weekend—and maybe, if you're unlucky enough to live in an area with persistent problems, for a while after that.

First, though, a review of where we stand now on PCs and Y2K.

In the PC world, we've been pretty fortunate: PCs shipping for the past year have had Y2K-compliant hardware. Beyond that, most PCs built since the mid-nineties are pretty easy to fix by replacing a BIOS chip, or sometimes simply by running a software patch. (You can find an excellent free PC BIOS test-and-maybe-fix utility, drawn from Symantec's top-grade software package Norton 2000, at *www.symantec.com/sabu/n2000/fs_retail.html.*) Older PCs remain problematic, but frankly, given the advances in PCs since 1994 or 1995, you shouldn't be running them for any critical work anyway. It's time to upgrade, for lots of good reasons beyond Y2K worries.

In PC networking, there are a fair number of noncompliant devices out there. The good news is that most networking products either don't know or don't care about the date, or are running on a "safe" calendar that begins in the 1970s. But even some very recent networking devices don't properly handle the leap-year date of February 29, 2000, which somehow got overlooked (don't ask). Check with your network-hardware vendor. Some have fixes; many offer trade-in deals (usually lowballed, though) for fairly recent noncompliant products.

In PC software, it's a mixed bag. Even products as recent as Microsoft's nearly ubiquitous Windows 95 and Office 97 have Y2K issues, though they may not affect you. You can find patches for many of those problems at *www.microsoft.com.* Windows 98 and the new Office 2000 suite and its components are said by Microsoft to be Y2K-problem-free.

For any PC software package you rely on, check with the vendor. PC software developers have, to be sure, put out some pretty vague and unreliable statements over the past year or so about their Y2K problems. But in the past six months, there's been a great improvement in the quantity, accuracy, and *usefulness* of vendor-provided Y2K-compatibility information. Check the Web sites of your key software's publishers.

For more structured information, and especially for testing—find out what your vendors say, but don't trust them without confirming their claims!—take a look at the Norton 2000 product mentioned above. In both an inexpensive personal version ($40 street) and a not-too-expensive corporate version (about $25 per seat), Norton 2000 is the best general-purpose Y2K testing package I've seen. Much more specialized (and more expensive) programs are available for corporate IT managers as well.

Actually, I don't worry so much about Y2K compatibility with recent software. I worry about

It's time, I think, to shift from a focus on our computers and software to the larger societal issues with Y2K.

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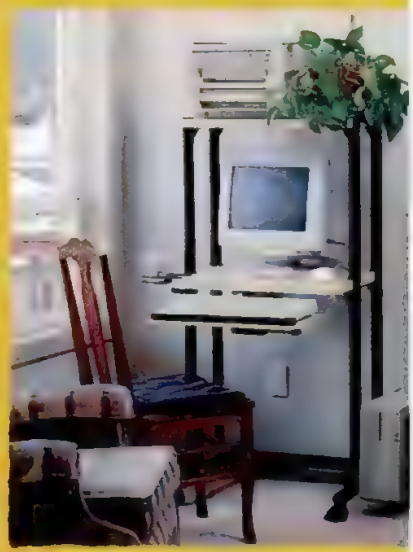

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ANTHRO

Jim Seymour

you—and me. No matter how much software vendors wring out their products, shedding bad code, most of the problems we'll see will arise from what we've done with those packages.

If you've routinely used two-digit year dates in your spreadsheet's date-calculation formulas and functions, for example, you may be in trouble. Most recent and all current spreadsheet software I know will automatically expand year dates for calculations if you've chosen to display them with only two digits—*but only if you've actually entered them as four-digit years.* Think about it: How else could they work?

Checking your own work can be daunting. How many spreadsheets have you built, and how many do you still use? How many of those have you passed on to others? And how many have been passed on even farther in your company, probably to people you have no idea use them? What about databases you've constructed, or more likely, into which you've entered date data?

How will you find that data and correct it as necessary? Waiting until problems arise is not a very smart option. Do you really want to go through every worksheet, cell by cell, and every database record, looking for bad data?

I've spoken to well over a hundred audiences around the country about Y2K issues over the past couple of years. I've been astonished to find how few people in those audiences had considered that *they* might be part of the Y2K problem, through sloppy habits in building and using PC spreadsheet and database programs.

And—True Confessions time—I'm as guilty as they are. Until we devoted most of a week to running down specific date entries in the data files in general use in my office, we had some problems. Umm—make that a *lot* of problems. Almost all of them caused by me, with my sloppy, lazy, two-digit year date data-entry habits.

And I'm supposed to *know* about this stuff.

Next time, I'll set the computer-specific items aside *and* focus on those larger societal issues I mentioned. This is important stuff; stay tuned. PC

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PC-Linked Devices

We gripe about how hard PCs are to use. But consumer electronics devices—TV remote controls, cell phones, and the like—are more of a bear to learn and use, in no small part because they have tiny buttons and programming that may go south when the batteries die. The consumer electronics industry is coming around to the idea that if you could use your PC to set up a device as well as back up its data, life would be better all around. To check how far we've come, I worked with two PC-linked telephones and two PC-assisted audio/video (AV) remotes. Then I compared them with the state of the art in non-PC high technology.

Nortel Networks Meridian 9617 USB telephone. This is a two-line speakerphone in familiar Nortel housing, with Caller ID, 100-name memory, and so on. The magic comes from a USB connection, which lets you set up the phone from your PC and then keep a caller log. If your PC is turned off or crashes, the 9617 stores data locally until the connection is restored. The gee-whizziest feature is OpenSpeech technology: When you say a command into the phone (such as "Call Gwen"), the PC translates the phrase and passes a dialing command back to the phone. Setup could be easier, though. The verdict: cool technology, high price ($360 list), worthwhile if you use the features. (800-466-7835, *www.nortelnetworks.com.*)

Microsoft Cordless Phone System. This bulky 900-MHz cordless phone with voice commands offers only the barest of functionality when your PC isn't connected. Want Caller ID? If your PC is on and hasn't crashed, the number pops up on your PC monitor or is announced by the phone. But there's no LCD panel on the handset or base, nor is there spread spectrum to safeguard your privacy. There's one line, not two, and the PC connection is serial, not USB. The phone lists for $159; it's free with some small-business versions of Microsoft Office. The verdict: back to the drawing board. (800-426-9400, *www.microsoft.com.*)

Harman Kardon Take Control System Controller. A universal remote ends the clutter of separate CD, VCR, TV, and AV receiver remotes on your coffee table. A programmable remote lets you create macros that can, for example, turn on all your components and start a movie playing with one button press. The Take Control ($350 list), jointly developed by Harman Kardon and Microsoft, lets you create macros on your PC and then download them via serial cable to your remote. For such a bulky device, the touch-screen characters are small. The verdict: nifty tool for people who don't mind a remote costing as much as some stereos do. (800-422-8027, *www.harmankardon.com.*)

Philips Pronto Intelligent Remote Control. This palm-size remote has bigger fonts than the Take Control does, but you have to move among more screens to issue commands. Otherwise it works similarly: You can set it up from your PC and download the commands. Also, there's a wealth of macros created by others that you can download from the Internet. The verdict: neat gadget, but not cheap at $395 list. (888-486-6272, *www.pronto.philips.com.*)

These PC-linked remotes aren't intimidating: They have only a handful of buttons, their touch screens do the work, and you can program in lots of macros, such as "Play a CD," to make things even easier. But if you want the very best AV remote, the hands-down choice is still the non-PC-assisted **Marantz RC2000 Mark II Programmable Learning Remote Control** ($250 list). It matches the others on functionality, and the unit is more compact than the Take Control (but not the Pronto). Other than the inability to store programming info on your PC, the Marantz RC2000 doesn't lack any features, although it's limited to four macros. The just-released Marantz RC5000 with a touch-screen panel ($500 list) will have PC programmability. (630-307-3100, *www.marantzamerica.com.*)

One caution: A macro such as "Watch a Movie" that includes, say, a "VCR Power" command will turn off your VCR if it was accidentally left on, because most AV gear lacks explicit on and off commands. No sub-$1,000 remote can deal with this. The most workable solution is drastic: Ditch your old AV gear (all of it) and buy a single brand that communicates among the components. Your best bets are Sony products (using a protocol called S-Link) or JVC devices (CompuLink). When you put a tape in the VCR, everything else turns on and adjusts automatically, like magic. And you don't need a PC to make it happen. PC

These PC-linked AV remotes have only a handful of buttons, and their touch screens do the work.

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PRESARIO 5600s INTERNET PC

	PRESARIO 5600s-475/2 INTERNET PC	PRESARIO 5600s-475/2 INTERNET PC	PRESARIO 5600s-475/2 INTERNET PC
	475 MHz AMD-K6®-2 with 3D Now!™ Technology	475 MHz AMD-K6-2 with 3D Now! Technology	475 MHz AMD-K6-2 with 3D Now! Technology
	64 MB SyncDRAM expandable to 384 MB	128 MB SyncDRAM expandable to 384 MB	128 MB SyncDRAM expandable to 384 MB
	10.0 GB UltraDMA Hard Drive[1]	10.0 GB UltraDMA Hard Drive[1]	13.0 GB UltraDMA Hard Drive[1]
	6X DVD-ROM Drive[4]	6X DVD-ROM Drive[4]	6X DVD-ROM Drive[4]
	2X AGP Graphics w/8 MB SDRAM	2X AGP Graphics w/8 MB SDRAM	Savage4 Pro 16 MB 2X AGP Graphics Card
	Creative Labs Sound Blaster™ 1373	Creative Labs Sound Blaster 1373	Creative Labs Sound Blaster 1373
	56K ITU V.90 Modem[2]	56K ITU V.90 Modem[2]	6.0Mb Max Digital Modem[3]
	JBL Pro Amplified Speakers	JBL Pro Amplified Speakers	JBL Pro Amplified Speakers
	Microsoft® Featured Home Collection + MS® Word	Microsoft Featured Home Collection + MS Word	Microsoft Featured Home Collection + MS Word
	Microsoft Windows®98	Microsoft Windows98	Microsoft Windows98
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6X DVD-ROM Drive[4]	6X DVD-ROM Drive[4]	6X DVD-ROM Drive[4]
Savage4 Pro 16 MB 2X AGP Graphics Card	Savage4 Pro 16 MB 2X AGP Graphics Card	32 MB Creative 3D Blaster TNT2 ULTRA Graphics Accelerator
Diamond Monster Sound MX300 PCI Audio Card	Diamond Monster Sound MX300 PCI Audio Card	ESS Solo PCI Audio
56K ITU V.90 Modem[2]	56K ITU V.90 Modem[2]	6.0Mb Max Digital Modem[3]
Klipsch v.2-400 Speakers	Klipsch v.2-400 Speakers	JBL Pro Amplified Speakers
Digital Creativity Imaging Center[3]	Digital Creativity Imaging Center[3]	Digital Creativity Imaging Center[3]
Microsoft Office 2000 Small Business®	Microsoft Featured Home Collection + MS Word	Microsoft Office 2000 Small Business
Microsoft Windows98	Microsoft Windows98	Microsoft Windows98
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Compaq Home

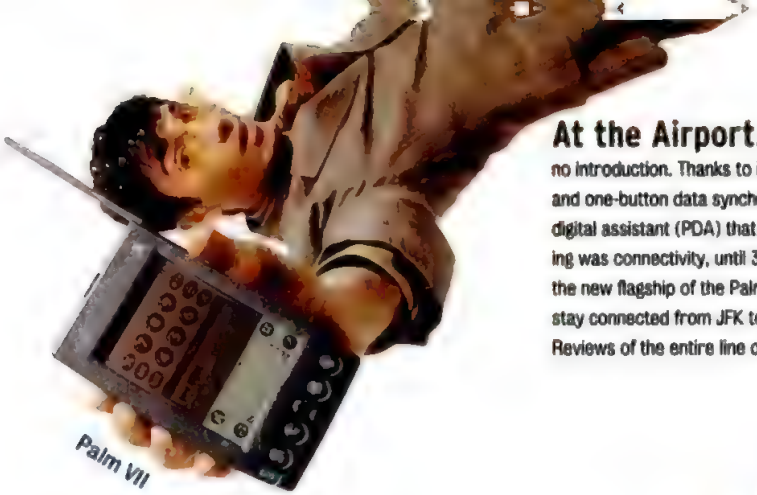
Cover Story

In Traffic... When you absolutely, positively have to get the message—a short message, at least—a pager is the most reliable means of staying in touch. The vast majority of pagers in use today are designed only to receive alphanumeric messages, but you don't have to settle for one of these "dumb" devices. With a smart pager, you can not only receive messages, but also reply to them using the pager's tiny keyboard. While sitting in traffic, you can check in on the opening bell, find out how the Lakers did last night, or even grab text from a Web site. Reviews start on **page 110**

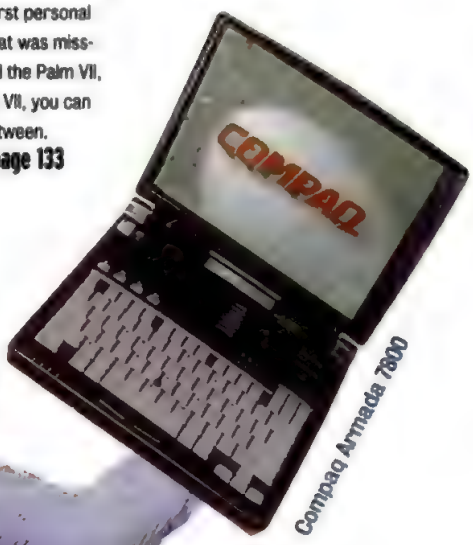
On Vacation... Face it, nowadays work doesn't come to a stop just because you're at the beach. But who wants to lug a laptop on vacation? The solution is a Windows CE device, which provides "pocket" versions of all the applications you've come to rely on, in a package that fits neatly in your overnight bag. For this story, we tested both palm-size PCs (P/PCs) and hand-held PCs (H/PCs). Reviews start on **page 148**

At Lunch... Thanks to simpler pricing and better cell phone designs, the U.S. market is finally starting to catch up with others parts of the world. You haven't seen anything yet. A new class of Web-ready phones is set to arrive this summer. These so-called smart phones have built-in browsers, called microbrowsers, which let you get at Web sites. Soon you'll be able to execute trades, purchase theater tickets, or book a flight—all while you're waiting for a table. Our sneak preview starts on **page 113**

PHOTOGRAPHY BY MARTY UMANS. STYLING BY MICHELLE McDONALD. HAIR AND MAKEUP BY DINA KINION. CLOCKWISE FROM TOP LEFT: JACKET, PANTS, AND TOP: WILLIAM B.



At the Airport... Palm connected organizers need no introduction. Thanks to its smart design, simple applications, and one-button data synchronization, it was the first personal digital assistant (PDA) that really caught on. All that was missing was connectivity, until 3Com recently released the Palm VII, the new flagship of the Palm family. With the Palm VII, you can stay connected from JFK to LAX and all points between. Reviews of the entire line of Palm organizers on **page 133**



On the Road... If you really need to take the office with you, only a full notebook PC will do. What laptops cost in size and weight, they make up for by giving you far more functionality than hand-held smart devices such as pagers, phones, and PC companions. With a notebook PC, you can run all the same applications you use at work (such as corporate messaging software), easily access files on your company's network, and use the latest Web browsers—even when stuck in a hotel suite. And, when on the road, only a notebook PC offers the big, bright screen you need for giving presentations. In this story, we test more than 50 notebook PCs in five categories: mini-notebooks, thin and light, mainstream, desktop replacement, and value. Reviews start on **page 156**

onnect ANYWHERE

BY ANDREW M. SEYBOLD

These days, work is wherever you happen to be. To cater to an increasingly mobile workforce, a bewildering array of platforms—from pocket-size pagers to shoulder-numbing desktop-replacement notebooks—has sprung up. Add in all the software and services that go along with staying connected and the mobile market becomes even more complicated. Our hands-on reviews will help you make sense of it all and select the solutions that fit the way you work.

EYEGLASSES: CUTLER & GROSS OF LONDON, EXCLUSIVELY AT GRUEN OPTIKA, NY. TIE: SULKA. SUIT, SHIRT, TIE, AND POCKET SQUARE: SULKA. SHIRT: SULKA. EYEGLASSES: GRUEN EYEWEAR. BATHING SUIT: ANNE COLE COLLECTION. COVER-UP: OSCAR DE LA RENTA.

Few technology prospects hold as much allure to mobile professionals as the idea of easy Internet access anyplace, anytime. But until recently, waiting for wireless data was like rooting for a perennially losing team: "Wait till next year."

For some time, we've heard how computers will soon come in all shapes and sizes, and how these smart devices will be able to talk to one another and to the Internet in the office, at home, or on the road. Yet the vision has been slow to materialize. Devices were poorly designed, the wireless networks were deemed too slow and expensive, and putting all the pieces together was too difficult. But those stumbling blocks are finally starting to fall, and 1999 is shaping up to be the year of wireless discovery.

There are many factors behind the emergence of wireless data as a mainstream technology, but the most important is the Internet. Use of the Internet, and in particular e-mail, as critical business tools has created new demand for ways of staying connected.

To meet that demand, wireless companies are coming up with solutions that are making wireless more practical for general business use. First, the range of devices that can be used to connect wirelessly has increased. Today, you can get wireless Internet access on everything from a 5-ounce pager to a 9-pound desktop-replacement notebook PC, with devices of all shapes, sizes, and capabilities in between. Second, the wireless networks now offer coverage of most business areas, more attractive flat-rate pricing (in most cases), and speeds that are sufficient for e-mail and basic Web browsing. Finally, wireless companies are waking up to the fact that they must provide integrated solutions.

A great example of these trends is the 3Com Palm VII, the latest addition to the Palm organizer line. At first glance, the Palm VII looks nearly identical to (albeit slightly longer than) the popular Palm III. But closer examination reveals a small antenna mounted on the side. When you first start the Palm VII, a wizard pops up. Enter a credit card number (of course) and within minutes you've established a wireless account with BellSouth Intelligent Wireless Network. To connect, you simply swivel the antenna to an upright position and you're ready to send and receive e-mail, check business headlines, download driving directions to your next meeting, or find the closest ATM.

If the Palm VII demonstrates the strengths of the new wireless solutions, it also underscores some of the weaknesses. You can't expect the same experience from a wireless device that you get from a desktop PC with a relatively "fat" pipe to the data and a big, bright display. Most wireless networks are limited to 19.2 Kbps; in practice you'll probably get about the same throughput as with a 14.4-Kbps modem. That's good enough for e-mail and text-based Web pages, but hardly sufficient for pages with graphics or multimedia.

Ultimately, wireless data is not about doing everything you can do in the office while you're on the road. Instead, it is about staying productive and on top of your business wherever you happen to be—on your way to work, at the airport, or in a meeting at the client site. For these tasks, we can say without hesitation that the wait is over.

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PUTTING TOGETHER THE PIECES

Today, you still can't walk into a store and pull a wireless solution—with the exception of the Palm VII and a handful of other

Choosing the Right Mobile Solution

FUNCTIONALITY KEY
Alerts/information services · PIM · Voice communications · Web browsing · E-mail · Document viewing/creation
A shaded icon denotes limited functionality

SMART PAGERS

SPECS: About 5 to 7 ounces including AA battery. Approximately 2.5 by 3.5 by 1 inches (HWD). Rated battery life of two weeks

COST: $350

PROS: Only two-way wireless messaging device that fits comfortably on your belt. Works in all major U.S. metropolitan areas. Also provides access to news, stock quotes, travel alerts, and other information

CONS: Cramped keyboards and downsized displays make pagers suitable only for very short messages—about one sentence

SMART PHONES

SPECS: Very widely depending on make and model. The Qualcomm Thin Phone weighs slightly more than 4 ounces, is about the size of a television remote, and has a rated 2.5 to 10 hours of talk time. At the other extreme, the Nokia Communicator 9000i, which includes a keyboard, weighs in at 14 ounces, and provides a rated 3 hours of talk time

COST: Varies from $100 to $1,000

PROS: Packs voice and data communications into one compact package

CONS: No keyboard on most models. The small display works only with Web sites optimized for smart phones

PALM-SIZE PCs (P/PCs)

SPECS: A palm-size PC is designed to fit comfortably in one hand or in a shirt pocket, but exact dimensions vary. The supersvelte Palm V is less than half an inch thick and weighs just 4 ounces (one to two months battery life). Windows CE–based devices tend to be a little larger. The Philips Nino 510 measures 3.4 by 5.3 by 0.8 inches and weighs 8 ounces (8 hours battery life)

COST: $200 to $600

PROS: Includes full-featured PIM and synchronizes easily with your PC

CONS: No keyboard and small screen. And no applications for true document creation, such as Pocket Word and Excel

HAND-HELD PCs (H/PCs)

SPECS: Closest in size and appearance to the smallest notebook PCs, but exact dimensions vary. Hewlett-Packard, for instance, has two new models: the HP Jornada 820 (2.5 pounds; 7.9 by 9.7 by 1.3 inches) and the HP Jornada 680 (1.1 pounds; 3.7 by 7.4 by 1.3 inches). Battery life for the class ranges from 8 to 15 hours

COST: $500 to $1,000

PROS: The only class of hand-held PDAs with a decent-size keyboard and SVGA or 800-by-600 display (some models). Includes pocket versions of Word, Excel, PowerPoint, IE, and Access

CONS: Can't run Windows 95/98 or NT. Almost as big as some mini-notebooks

NOTEBOOK PCs

Just about all the features of a desktop PC in a portable package. In this story we review five different classes.

Mini-Notebook

For the mobile professional who values size and weight (just 3.5 to 4 pounds) above functionality

COST: $1,750

PROS: Almost as small as some H/PCs, yet runs Windows 98

CONS: Compact keyboard and screen. Floppy disk and CD/DVD drives are typically external. Limited input/output ports

Thin and Light

For the business user who carries a laptop every day to read e-mail and work on files

COST: $2,500

PROS: Full-size keyboard and screen (12 or 13 inches) in a supersslim (1-inch-thick), super-light (5- to 6-pound) package

CONS: Floppy disk and CD/DVD drives are typically external

Mainstream

For the mobile professional seeking a full-featured system in a compact package and corporations seeking a moderately priced solution

COST: $2,000

PROS: Full-size keyboard and screen (13 to 14 inches) in a midsize package (7 to 8 pounds). One or two bays for swappable peripherals.

CONS: Weight may be an issue for frequent travelers.

Desktop Replacement

For the executive who wants the power of a desktop PC

COST: $3,000 and up

PROS: Full-size keyboard and massive screen (15 inches). Expansive hard disk plus swappable bays for DVD drive, floppy disk drive, or spare battery.

CONS: Your shoulder will never be the same (weighs about 8 to 9 pounds)

Value

For price-conscious home and SOHO users

COST: $1,500

PROS: Full-size keyboard and screen (13 inches). Built-in hard disk, floppy disk drive, and CD drive.

CONS: Larger and heavier (7 to 8 pounds) than other notebooks, with fewer bells and whistles.

devices—off the-shelf. The reason is that a wireless data solution is not a single product. It takes several pieces to make it work.

The first is the mobile computing device itself. Pagers, cell phones, palm PCs, hand-held PCs, and notebook PCs can all serve as platforms for wireless data communications. Because each has different capabilities, many mobile professionals carry as many as three such devices at a time while on the road. Second, you need a wireless modem. Some devices (pagers and cell phones) have them built in; other products (Windows CE-based devices, notebook PCs, and most Palm organizers) require a third-party product that you connect to the unit via PCMCIA or a serial port. Finally, you need a subscription to a wireless network service.

For this cover story, we looked at all of the pieces to the wireless puzzle. In all, we tested 77 different devices, every wireless modem we could get our hands on, and all of the wireless networks that provide widespread coverage of business centers. Our goal: to describe all the options available, find out what works and what doesn't work, and tell you how much it will cost to put it all together. If you can't find a wireless solution here that meets your needs, it doesn't exist.

THE HARDWARE

Notebook PCs have long been an established tool for road warriors, of course, but smaller devices have had a harder time reaching critical mass. The list of failed PDAs (personal digital

assistants) is long; the Apple Newton comes to mind. But all that started to change when, in 1996, 3Com introduced the first Palm organizer, then known as the PalmPilot. The Pilot was the right size and shape to fit in a shirt pocket, and the HotSync button on its cradle made it easy to exchange data with a desktop PC.

The surprising success of the Pilot paved the way for a whole new class of "PC companions," and induced Microsoft to enter the market with its Windows CE operating system. As a result, today there is a broad array of mobile gadgets that can exchange data with PCs and, with the right accessories, keep you connected.

The smallest and lightest of these devices is the smart pager. Most pagers in use are relatively dumb devices designed only to receive numeric or alphanumeric messages, but smart pagers let you not only receive messages but also reply.

The contenders in this category are the Motorola PageWriter 2000 and Research in Motion Ltd.'s RIM Inter@ctive 950 Pager. The miniature screens and keyboards on these pagers make them suitable only for quick messages. But for an added fee, you can use third-party services to access content on the Web.

Like pagers, most cell phones are dumb devices—designed strictly for voice communications. Internet-enabled phones, such as the Mitsubishi Mobile Access 120 and Samsung Duette (both of which use the AT&T PocketNet service) and the Nokia 9000 Communicator, have actually been around for about three years. But they never really caught on because the phones were too big and too complicated to use, and the service pricing was too complicated.

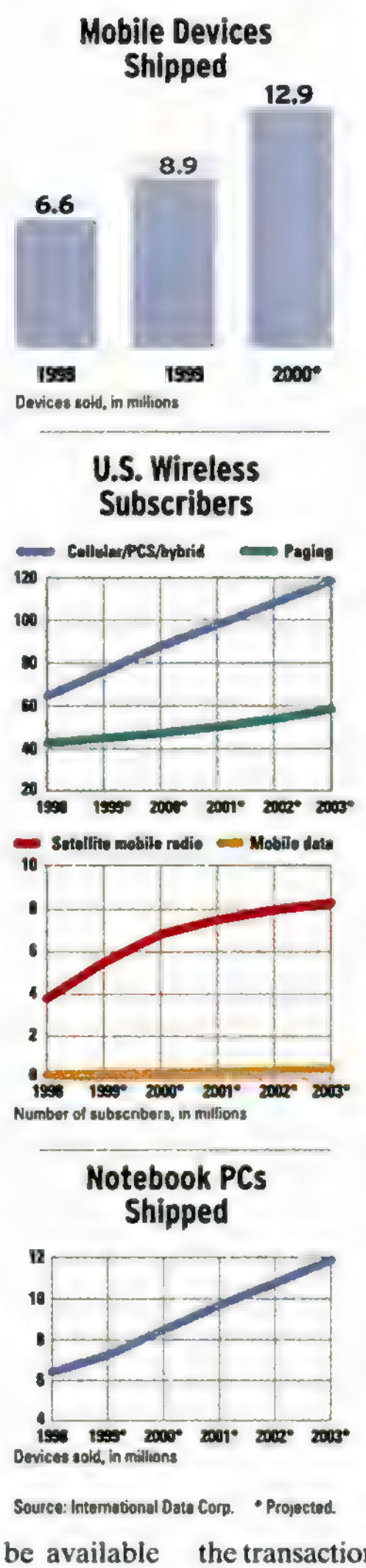
Last year, AT&T introduced a flat rate for calls anywhere in the U.S. that, combined with sleek phones such as those of the popular Nokia 6100 series, rapidly accelerated cell phone adoption and created a new opportunity for more advanced cell phones. For this story, we got a preview of smart phones from Motorola, NeoPoint, and Qualcomm—many of which should be available around the time you read this. These cutting-edge phones have larger displays, built-in PIMs, and *microbrowsers* that let you access the Web.

If the changes in pagers and cell phones are radical, the new features in larger devices based on the Palm OS or Windows CE are more incremental. The most noteworthy changes have been the introduction of the Palm VII and the color displays on new Windows CE palm-size PCs (P/PCs). 3Com has generally stuck to its market-winning KISS (Keep It Simple, Stupid) approach for the Palm organizers, while Windows CE P/PCs keep getting new multimedia features, and hand-held PC Pros, or H/PC Pros (also known as Jupiters), look and perform increasingly like thin notebooks.

For the next 6 to 18 months PDA manufacturers and operating-system vendors will test market acceptance of PDAs combined with telephones and pagers; PDAs that play music, games, spoken audio, and video files; and PDAs that, like the Palm VII, let you connect to e-mail systems and to the Internet wirelessly in U.S. metropolitan areas.

The former Holy Grail of portable personal electronics, a single device combining the functions of PIM, telephony, paging, voice recording, multimedia playback, and productivity tools isn't a feasible development target for the next few years, because there is little market demand for such a product. Single-purpose personal electronic appliances will continue to dominate the PDA market.

Of course, we already have a single device that can do many of these tasks: a notebook PC. Notebooks are obviously bigger and heavier than PC companions—although this year we saw several mini-notebooks running Windows 98 that were comparable in size to H/PC Pros—but for creating documents, reading full Web pages, or giving presentations, there's still no substitute. In this roundup, we look at more than 50 systems divided into five categories: mini-notebooks, thin and light, mainstream, desktop replacement, and value.



Source: International Data Corp. * Projected.

WIRELESS 101

Wireless data services are hardly a new concept. Private networks have been used for specialized purposes such as railroads, police, and taxi dispatch services for two decades. Today, wireless technology affects you in many ways every day. When FedEx delivers a package, for example, the transaction is recorded wirelessly in real time. When you rent from Avis or Hertz, the companies use wireless terminals to make sure the car is waiting for you. And when you call a technician to service an appliance, chances are that the call was dispatched wirelessly.

Wireless data has made some inroads as a mainstream application for business professionals as well. A few companies with large, mobile sales forces, such as IBM, have adopted wireless data technology. But the number of users of wireless data, as

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opposed to voice, is still in the hundreds of thousands—a tiny fraction of computer users.

Not surprisingly, the choices for wireless data service are still fairly limited. For this story, we tested three services: AT&T Wireless IP (CDPD), BellSouth, and Metricom's Ricochet. CDPD and BellSouth offer coverage of most major metropolitan areas; Ricochet is currently available only in three areas (San Francisco Bay Area, Seattle, and Washington, DC). The speed of the networks also varies. Ricochet offers throughput speeds of up to 28.8 Kbps, making full Web browsing feasible, but CDPD and BellSouth are only suitable for e-mail and text-based browsing.

Not all of these services work with all the types of devices reviewed in our story, so it is important to consider the type of network service you want to use when selecting the hardware. Ricochet, which uses its own modem, works only with laptops running Windows or the MacOS; BellSouth works with both laptops and Windows CE-based devices (as well as the RIM Inter@ctive 950 Pager). CDPD networks such as AT&T Wireless IP get along with the broadest range of devices, including phones, Palm organizers, Windows CE-based devices, and notebooks PCs.

Although these solutions are fine for e-mail and basic browsing, there's clearly a demand for faster wireless access. Several telecommunications companies are vying to build a better wireless data network. In the short term, this will be accomplished by tacking extra capabilities onto existing networks using cellular (TDMA, CDMA) and Personal Communications Services (GSM, the standard in Europe that companies such as OmniPoint are pushing here in the U.S.). These interim or so-called *2.5G* solutions could deliver wireless access in the range of 64 Kbps to 128 Kbps starting as soon as the end of this year. In the long term, *3G* (third generation) aims to unify the cellular and PCS networks and provide 384 Kbps, enough to deliver audio and video on demand, as well as data.

INTEGRATION

All this sounds promising, but as we discovered during testing, despite the efforts of individual vendors to improve integration, bringing together all the pieces is still no easy task. If you decide to go wireless now, there are several third-party vendors—some of which we relied on during testing—that can make the process much easier by bundling all the necessary hardware, software, services, and support in a single package. These companies include GoAmerica Communications Corp. (*www.goamerica.com*), which provides turnkey solutions for both CDPD and BellSouth; Infowave (*www.infowave.com*), which sells solutions for companies using Microsoft Exchange; and WirelessKnowledge (*www.wirelessknowledge.com*), a joint venture of Microsoft and Qualcomm.

Despite lingering difficulties with deploying wireless data solutions, the technology is no longer black magic. There are a wide variety of easy-to-use devices to choose from, wireless networks offer decent coverage at predictable prices, and vendors are now building applications and Web sites to make the most of them. All of this means that it's time to give wireless data a second look. You can keep waiting for the next great advance in wireless data technology, or you can put together a solution today that will give you a technological edge. Here's how to do it.

PC MAGAZINE EDITORS' HOT LINKS

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Looking for a new hand-held PC, peripheral, or hand-held application? PC Magazine Online is the first place to look for reviews of the best products. For further resources and information on the growing hand-held device market, take a look at these other helpful sites.

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Microsoft's official Windows CE home page guides you cleanly to lists of compatible products, developer resources, and special material for enterprise and embedded Windows CE solutions.

➤DirectCE
www.directce.com
Billing itself "Your Complete Windows CE Resource," the DirectCE site includes news and reviews of the latest Windows CE devices, as well as links to manufacturers and third-party vendors.

➤PalmCentral.com
www.palmcentral.com
From synchronization software to football schedulers, PalmCentral.com offers an extensive list of software downloads for PDAs. There's also a bookstore, a Palm chat room, and the latest in palm computing news.

➤Wireless Data Forum
www.wirelessdata.org
This site, complete with wireless market data, background information, and coverage maps, is a good place to start when you're considering going wireless.

➤Phone.com
www.phone.com
Formerly Unwired Planet, Phone.com is a software company that makes wireless devices Internet-accessible. Its official site includes industry updates and hardware links.

➤The World of Wireless Communications
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This wireless world e-zine offers all conceivable information about the wireless industry, from where to get job training to seminar schedules and fresh industry headlines.

➤The PCIA Home Page
www.pcia.com
The Personal Communications Industry Association offers daily news and financial updates for the wireless world, plus Y2K advice for telephony environments.

➤WirelessReady Alliance
www.sierrawireless.com/alliance
A trade group devoted to promoting integrated wireless data solutions, the WirelessReady Alliance includes hardware and software vendors and wireless service providers. Although it is led by Sierra Wireless, the group is not focused solely on CDPD and promises to promote other technologies such as CDMA.

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Smart Pagers

By Bruce Brown

Hurrying through an airport? Stuck in traffic in a cab? No matter where you happen to be, you can still send and receive e-mail or access the Internet—all from a device that fits on your belt.

Two-way pagers are a bit bigger, heavier, and larger than conventional one-way pagers, but they do a lot more. In addition to receiving numeric and alphanumeric pages, you can send short messages. Built-in PIM software lets you keep track of contacts. And, while you can't browse the Web in the full sense, you can get news alerts. Third-party software and services expand the content offerings.

For this story, we tested the two smart pagers currently available that incorporate miniature keyboards: the Motorola PageWriter 2000 and the RIM Inter@ctive Pager 950 from Research in Motion.

We asked novice and experienced users to complete a series of tasks with each pager. All were able to enter contacts into each pager's address book and compose and send short messages with little difficulty. But we don't recommend using a pager for any message longer than a sentence or two. Two-way pagers won't replace other mobile devices such as palm-size PCs and hand-held PCs, but for urgent, on-the-go communications, they can't be beat.

The PageWriter 2000 looks like a tiny notebook PC.

Like a miniaturized notebook PC, the **Motorola PageWriter 2000** ($360 list) has a clamshell design, measures 2.5 by 3.6 by 1.0 inches (HWD), and weighs 6.8 ounces with the battery. Flip it open and you'll find a 16-line by 30-character LCD screen that glows brightly (black letters on a blue background) with backlighting turned on and a 47-key keyboard with a flat, joystick-like cursor controller.

Inside, the PageWriter has 256K of RAM and 1MB of flash memory—enough to store 10,000 messages of 100 characters each. A new version, the PageWriter 2000X, should be shipping by the time you read this; it will boost memory to 4.5MB and include backlit keys. Our test unit had a rechargeable nickel hydride battery good for a week's heavy use, a charger/docking station with AC adapter, and a data cable and software to connect the pager to a PC.

The cost of the SkyTel plan varies from $20.70 to $59.95 per month depending on usage. We also tested the PageWriter with two third-party services that deliver news and information to your PageWriter for an extra fee: WolfeTech's PocketGenie and Software Incubators' StockBoss 2000.

Both of these services worked without a hitch, as did SkyTel's two-way messaging. Testers found the PageWriter's graphical main menus slightly more difficult to navigate than those of the RIM.

That said, the PageWriter has some decided advantages. First, the keyboard is larger and has 16 more keys than the RIM. Second, the PageWriter's screen enhances text readability. Last, its clamshell design lets you quickly flip down the screen to check messages without even removing the PageWriter from its waist holster. These design traits give the PageWriter a slight edge. (Motorola Inc., Schaumburg, IL; 800-548-9954, ext. 2; *www.motorola.com.*)

The **RIM Inter@ctive Pager 950** ($350 street) looks and feels more like a conventional pager. At 4.8 ounces (with a double-A alkaline battery rated for two weeks) and 2.5 by 3.5 by 0.9 inches (HWD), it is lighter and smaller than the PageWriter. The display measures just 165 by 132 pixels.

Like the PageWriter, the RIM includes 1MB flash memory, which the company says is sufficient to store 12,000 typical-size messages or 2,000 contacts (it has only 176K of RAM). Our test system did not come with a data cable or PC software.

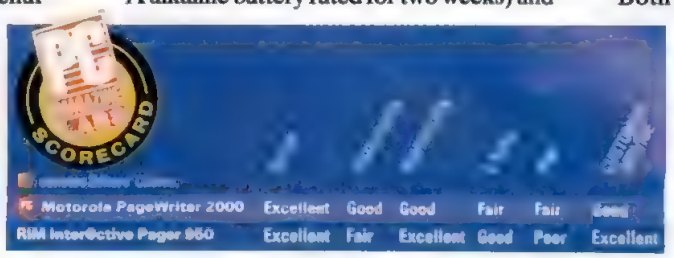
We tested the RIM with BellSouth's Interactive Paging Service. Pricing plans start at $29.95 a month for as many as 50,000 characters. BellSouth offers its own information service, a competitor to PocketGenie, that starts at $2.95 a month.

Testers took a few tries to get used to the RIM's text-based interface, but once they mastered it, most found it easier to navigate than the PageWriter's. The RIM is also better for one-handed operation, especially if you're right-handed. The scrolling wheel in the upper-right corner is all you need to find your way around.

The RIM is slightly smaller and has fewer keys.

Delivery and retrieval times for e-mail messages were not noticeably different from those of the PageWriter. However, the RIM's backlighting is not as bright, which makes it a bit tougher to read messages in dim light. (Research in Motion Ltd., Waterloo, Ontario, Canada; 877-255-2377; *www.rim.net.*)

Both the PageWriter and RIM have become platforms for third-party software and services. As these projects come to fruition, smart pagers will start to make the transition from niche product to viable alternative for professionals who want reliable, portable messaging.



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Smart Phones

Phones that can browse the Web and send and receive e-mail are not a new concept, but this time the industry seems to have gotten them right. By 2002, according to estimates by International Data Corp., some 6 million people will be using smart phones. You'll want to be one of them. Here's a sneak preview of some of the most promising models set to debut any day now.

The Wireless Web

Because of their small screens and lack of support for color or graphics, smart phones are hardly suitable for browsing the Web the way you're used to doing with a PC. Instead, they will require content that is designed specifically for them, and already a large field of computer and telecommunications companies are jockeying to make this happen.

At the forefront of this effort is Phone.com (formerly Unwired Planet), which developed the microbrowser that will be found in many of the smart phones shipping later this year. Its primary competition will be Microsoft, with its pocket version of Internet Explorer.

Microsoft has already launched its MSN Mobile wireless portal, based on its acquisition of OmniBrowse, and the company has forged separate deals with Qualcomm and Nextel to develop wireless applications and content further. Motorola and Nextel are working with Netscape to develop a smartphone version of NetCenter for the Motorola i1000plus. Meanwhile, Lucent Technologies has licensed Custom NetCenter from Netscape in an effort to build its own wireless portal, which is called Zingo. Other companies to watch in the wireless portals space include AvantGo, GoAmerica Communications, Saraïde.com, and Yahoo!

Most of these applications and services will be based on an emerging standard known as Wireless Applications (WAP), a communications protocol based on XML to reformat content for the screens on pocket-size devices. WAP is designed to work with any operating system and on most widely deployed networks.—*Maggie Overfelt*

Silver Bullet... Start-up NeoPoint Corp.'s first product is the **NeoPoint 1000**, an innovative-looking phone with a relatively large, graphical display and a sleek, metallic exterior (5.5 by 2.1 by 1.0 inches and 6.4 ounces). The 1000 offers rated 3 hours talk time and 30 to 40 hours standby time with the slim, lithium ion battery. NeoPoint has partnered with well-known vendors to deliver all the functionality you'd expect in a smart phone, including wireless Internet access (Phone.com), PC synchronization (Puma Technology), and data-entry (Tegic Communications). Our phone was not a working model, but NeoPoint promises that all these applications will be accessible from icons on the phone's 11-line, 24-character LCD. Like the Qualcomm phones, the NeoPoint is designed for CDMA networks and will be offered by PCS vendors such as Sprint at prices ranging from $300 to $400. (NeoPoint Corp., La Jolla, CA; 888-458-4447; *www.neopoint.com.*)

Trekkie Toy... The new **Motorola i1000plus** is much more than just another digital cell phone. This slick little device, which looks remarkably like an old "Star Trek" communicator, adds wireless Internet access to the two-way radio and pager capabilities of the original i1000. Throw in two-way text messaging, a microbrowser, modem, and faxing and you have the closest thing to a hand-held all-in-one communications solution—all in a package that measures 4.5 by 2.2 by 1.2 inches (HWD) and weighs 5 ounces with a slim lithium ion battery (180 minutes talk time; 30 hours standby). With our test phone, we were able to check stock quotes and retrieve news headlines and sports scores on the phone's LCD. Exact pricing hasn't been set, but the i1000plus should cost less than $300, and will be available on the Nextel network later this year. (Motorola Inc., Schaumburg, IL; 800-453-0920; *www.motorola.com.*)

Palm Inside... Qualcomm is covering its bets with two smart phones, each with very different personalities. The **Qualcomm pdQ smartphone** has drawn a lot of attention because it looks like (and essentially is) a digital phone that swallowed a 3Com Palm organizer. But the **Qualcomm Thin Phone** could make an equally big impression once users discover how much they can do with a 4-ounce phone that measures 5.5 by 2.0 by 0.7 inches (HWD).

The pdQ looks like a regular phone, at 6.2 by 2.6 by 1.4 inches and 10 ounces. But flip down the keypad and the pdQ suddenly becomes a Palm organizer. Qualcomm has added its own suite of applications for e-mail and Web browsing. The pdQ is rated for 2.5 hours talk time and 40 hours standby time with the standard lithium ion battery; it should cost anywhere from $500 to $1,000. Less is more with the Thin Phone. Its emphasis is on size and battery life. The Thin Phone has an internal battery (2.5 hours talk time; 3 to 4 days standby), and you can snap on an additional external lithium ion battery to get up to 10 hours talk time and 17 days standby time. (Qualcomm Inc., San Diego, CA; 619-587-1121; *www.qualcomm.com.*)

Unified Messaging

By Greg Alwang

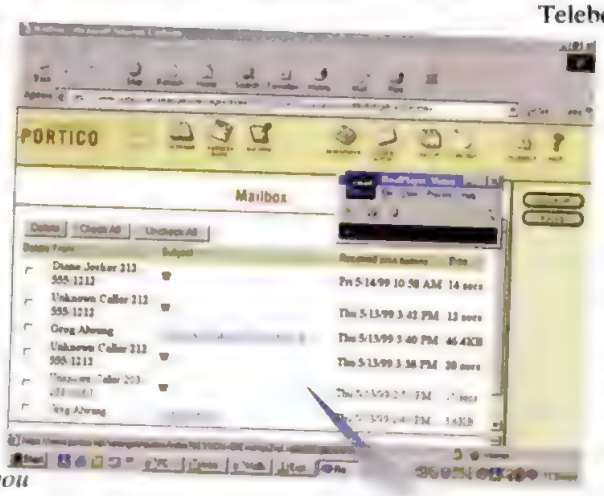
Communications technology was supposed to set us free, but somehow it hasn't: We're drowning in messages. To make matters worse, they are scattered in different locations. Voice mail can be retrieved only from a phone, e-mail is accessible only from a PC, and faxes sit in the machine's tray until you get a chance to pick them up. If you travel often, keeping up with voice mail and e-mail is even harder—forget about faxes.

The solution is a service, known as unified messaging, that consolidates all of your voice mail, e-mail, and faxes in one mailbox. Ranging in price from $10 to $20 a month, these services provide you or your business with a telephone number for incoming voice messages and faxes, and an e-mail address.

But the real advantage is that the service makes it much easier to retrieve messages. From any phone, you can not only listen to voice mail but also to e-mail and faxes, and reply to them. Conversely, from any PC with Internet access, not only can you retrieve e-mail, but you can also read faxes and listen to voice mail messages—all from the same Web page.

For this story, we tested four unified messaging services sold directly to individuals, SOHO users, and small businesses. You may never have heard of them because unified messaging is still relatively unknown. But that should change over the next year as telephone companies, Internet service providers, and Web portals such as Yahoo! start offering these services to mobile professionals.

The veteran in this new market, **JFax.com Unified Messaging,** began life about five years ago as a fax service and has since broadened its focus to include e-mail and voice communications. The service, which costs $12.50 per month (plus a $15 activation fee), also offers the unique ability—at least in this category—to send faxes from any Windows application (10 cents per minute), making it a good fit for those who rely heavily on faxing.



Portico's polished HTML interface displays details of your voice mail and e-mail messages.

JFax provides a single, toll number for use anywhere in one of 60 countries for unlimited incoming voice mail, e-mail, and faxes. (Toll-free JFax numbers are available for an additional 20 cents per minute line charge.) You also get a toll-free number for listening to your voice mail, e-mail, and fax headers.

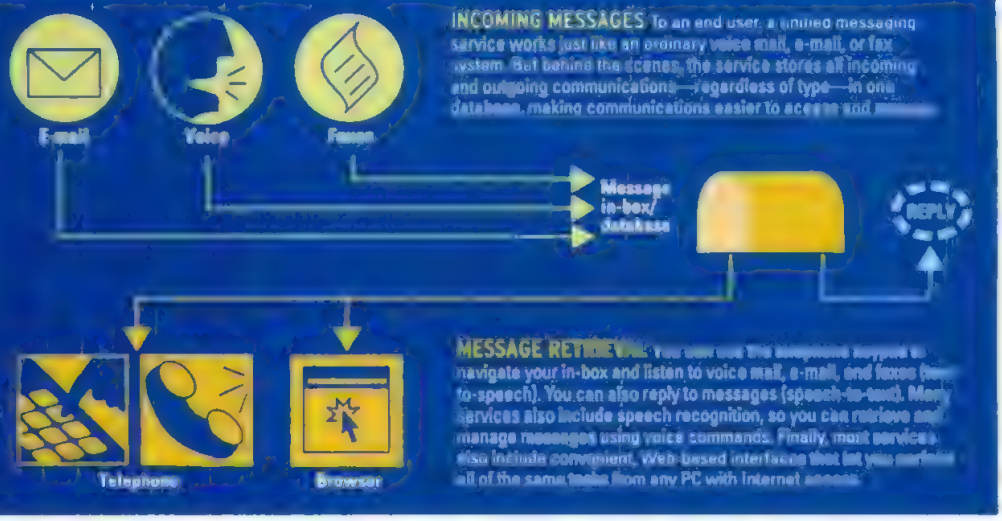
Unlike General Magic's Portico and Telebot Services, JFax uses your existing e-mail accounts. You can link up to three POP3 e-mail accounts to JFax for access by phone. From a Web browser, you can configure JFax settings such as audio and fax image file formats, and select from 18 languages for voice prompts. But you can't access messages from the Web.

JFax has most of the basics, but it must provide access to messages via a Web browser to match competitors. Furthermore, JFax lacks more advanced telecommunications features. But with partnerships with heavyweights such as America Online, CompuServe and Yahoo!, and a service upgrade in the works, expect to see JFax catch up quickly. (JFax.com, Los Angeles; 888-438-5329; *www.jfax.com.*)

As its name implies, Premiere Technologies' **Orchestrate Personal Assistant** wants to be the virtual executive assistant. That's a big task, but Orchestrate is on the

How Unified Messaging Works

For a monthly service charge ranging from $10 to $30, a unified messaging service provides you or your business with a new personal phone number, an e-mail address, and a fax number that you can give to customers, colleagues, and friends. Some services give you a toll-free number; others let you select the city and state. Depending on the service, you may be able to use your existing e-mail account.



INCOMING MESSAGES To an end user, a unified messaging service works just like an ordinary voice mail, e-mail, or fax system. But behind the scenes, the service stores all incoming and outgoing communications—regardless of type—in one database, making communications easier to access and

MESSAGE RETRIEVAL You use the telephone keypad to navigate your in-box and listen to voice mail, e-mail, and faxes (text-to-speech). You can also reply to messages (speech-to-text). Many services also include speech recognition, so you can retrieve and manage messages using voice commands. Finally, most services also include convenient, Web-based interfaces that let you perform all of the same tasks from any PC with Internet access.

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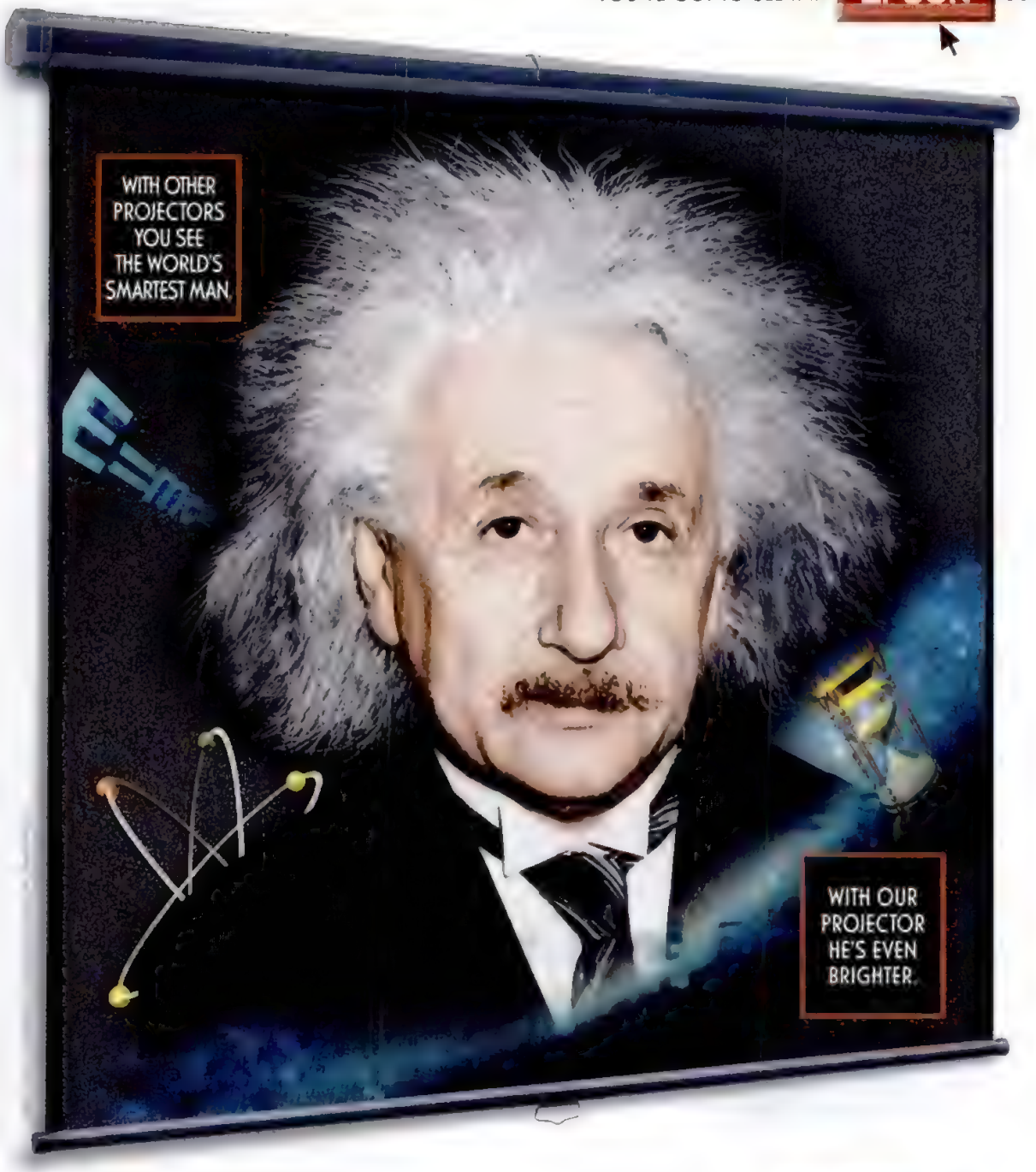

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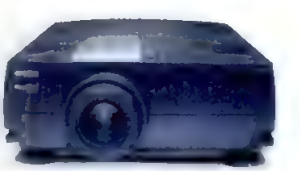

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right track with a broad array of communications services. Of course, the $9.95 a month service (plus 15 cents a minute for phone access) provides quick access to e-mail, voice mail, and faxes, but there's more: You can find out how the stock market did or check the latest NBA scores by phone. And Orchestrate's concierge service will even help you purchase theater tickets or send flowers.

Subscribers get a single number for accessing voice mail, faxes, and e-mail, and everything is done via phone touch pad. Although you can listen to fax headers by phone, you must forward faxes to a fax machine to read them in their entirety. All messages are deleted after seven days. Like JFax, Orchestrate currently lacks browser-based access.

Orchestrate has a call forwarding or "follow-me" option that can ring up to three phones simultaneously. You can screen calls and set up conference calls with up to eight participants, but Orchestrate does not offer the breadth of conferencing features found in Webley.

Premiere Technologies offers a more full-featured package, Orchestrate Office ($29.95 a month), with expanded conferencing capabilities, browser-based access, a POP3 account, and a personal Web page. (Premiere Technologies Inc., Atlanta; 404-262-8400; *www.orchestrate.com.*)

One of only two voice-controlled products in this roundup, General Magic's **Portico** adds the features of a PIM to the unified mailbox concept: It lets you use voice commands to access messages, contacts, appointments, and even get the latest business and stock news. This approach is more natural and convenient than using either the phone touch pad or a Web browser. With the addition of faxing, which General Magic plans to roll out by the time you read this, Portico will be an excellent unified messaging solution.

At $19.95 a month (and a $50 setup fee), Portico is one of the more expensive services we tested, but the price includes 60 minutes of phone access per month (20 cents per minute for additional minutes). General Magic includes both a Quick Start guide and a pocket reference, and it was the only service that provided a 10-minute walk-through by a customer service representative.

To access information, you simply say "open mailbox" or "open calendar." Ask Portico "Do I have any appointments today?" and it will read you what you have scheduled for the day. Portico makes navigation by voice easy; you can always say "go to the desktop" if you get lost or if you want to start over. Portico also offers a Web-based interface from which you can access e-mail or retrieve voice mail using RealNetworks' RealPlayer, a free plug-in.

The follow-me feature forwards your calls to specific phone numbers depending on the day of week and time. To avoid e-mail clutter, Portico lets you forward e-mail from several accounts into your separate Portico mailbox based on rules you create. You can import or sync contacts (but not calendars) from PIMs, and then dial them by voice.

Portico's information services provide immediate access to business news and stock quotes. These offerings are not as diverse as those in Premiere Technologies' Orchestrate Personal Assistant, but they are customizable. (General Magic Inc., Sunnyvale, CA; 800-767-8426, 408-774-4000; *www.generalmagic.com.*)

Of the services we tested, **Webley** currently comes closest to tying together all your communications needs in one neat package. Like General Magic's Portico, Webley uses convenient, speaker-independent voice recognition for managing voice mail and e-mail, but it also supports faxing. Alternatively, the $14.95 per month (plus 14.9 cents per minute) service includes a browser-based interface. And it offers powerful telecommunications features.

Webley provides you with your own toll-free number, which becomes your voice mail and fax number as well as your point of access to e-mail–by–phone features. A pocket reference guide covers the main voice features, such as "listen to messages," "check my e-mail," or "set up a conference call." Webley was not as easy to navigate by voice as Portico, and we got stuck a few times. Fortunately, you can say "cancel" or press * to back up a step.

A security code and password get you into the Web site interface, letting you configure Webley, listen to voice mail, view faxes, manage contacts, and set up conference calls. Webley charges a flat rate of 14.9 cents per minute of the conference call, a major savings over traditional conferencing.

For voice mail messages, Webley captures the caller's telephone number, so you can just say "return the call" and Webley dials the last caller. The Caller ID can be announced for incoming voice calls, letting you accept the call or have Webley take a message. Though some services have a locator option that sequentially rings numbers until you're found, Webley's Call Blast *simultaneously* rings up to four phone numbers. (Webley Systems Inc., Deerfield, IL; 888-444-6400; *www.webley.com.*)

PROFILE

TED M. YOUNG

• Founder and CEO, Advanced Web Technologies Corp.

"I'm willing to put up with the weight of my Inspiron [9 pounds]. It's fast enough to be my main system, compatible with most projectors, and the built-in DVD drive and bright, 14.1-inch screen are great for watching movies."

Java Jeopardy and Koosh balls aren't exactly the typical tools of the trade for mobile professionals, but these props are essential to Ted M. Young, who travels throughout the country teaching Java development techniques in corporations and public classrooms. The founder and CEO of San Francisco–based Advanced Web Technologies Corp., Ted travels as often as once a week on training projects that last several days. In addition to his props, Ted never leaves home without his Dell Inspiron 7000 notebook PC, 3Com Palm III organizer, and cell phone. His tip for other business travelers: Always carry energy bars. They're compact, and they can keep you going when the plane's sitting on the runway.

Wireless Networks

By Les Freed and Robert P. Lipschutz

Now that e-mail has become an essential business tool, many users are finding that they can't afford to be without it—even for an hour or two. The answer for these e-mail addicts is a wireless data solution.

These solutions consist of the service itself, a hardware device such as a 3Com Palm organizer or hand-held or notebook PC, and a wireless modem to access the service. What you can do depends on the service you choose. All of the services provide wireless e-mail, but some also provide wireless IP connectivity so that you can browse the Web or access corporate data from your car, your commuter train, or the airport departure lounge.

For this story, we tested three solutions based on the services with the widest coverage areas: AT&T Wireless IP (CDPD), BellSouth Intelligent Wireless Network, and Metricom's Ricochet. We did not test American Mobile Satellite's Ardis, because the company has shifted its focus to a two-way messaging product designed strictly for Research in Motion's RIM Inter@ctive Pager 950.

Browsing the Web with **AT&T Wireless Services** tends to bring back memories of the days when modems ran at a leisurely 14.4 Kbps. Nevertheless, it is the only service currently available that lets you pick your weapon for wireless e-mail and Internet access throughout the country. Notebooks, Windows CE devices, 3Com Palm organizers, and smart phones—AT&T Wireless works with them all. This, combined with a predictable pricing plan, makes AT&T Wireless the leading solution for companies that need wireless IP now.

AT&T is the largest of several carriers—Ameritech, Bell Atlantic, GTE, and SBC are the others—that have wireless data networks based on CDPD (Cellular Digital Packet Data) technology. Because AT&T has interoperability agreements with the other CDPD carriers, you can get service in over 3,000 cities nationwide.

Unlike BellSouth, AT&T Wireless has flat-rate pricing plans. There are two levels for unlimited use: $54.99 a month for users who do not stray from the AT&T Wireless IP network and $64.99 a month for frequent fliers who need to take advantage of AT&T's interoperability agreements.

Initial hardware costs vary greatly depending on the type of device and modem. We field-tested the service on an IBM ThinkPad 560X notebook PC with an Inet Spider Type III PC Card modem ($499 list with a one-year service contract). We also tried the service using an NEC MobilePro 800 hand-held PC with a Sierra Wireless AirCard 300 Type II PC Card, and 3Com Palm organizers with Novatel Minstrel modem cradles.

The RIM Wireless PC Card is designed for BellSouth's network.

All of these solutions were provided by GoAmerica Communications, a wireless system integrator that resells CDPD service in two plans: Go.Unlimited ($59.95 per month) and Go.Lite ($9.95 per month for first 25K). Once connected, you can do anything you'd do with a conventional, dial-up IP connection, albeit more slowly. We tested the service running Microsoft Internet Explorer, Netscape Communicator, Microsoft Outlook Express, and AOL's ICQ, an instant messaging client. All worked without a hitch.

Although AT&T claims the service can reach speeds of 19.2 Kbps, our connections ranged from 2.2 Kbps to 12.5 Kbps, depending on our location. In a few cases when we couldn't obtain a connection, we were usually able to fix the problem by moving the system a few inches.

As AT&T and other cellular carriers move towards all-digital networks, CDPD will likely become obsolete within two or three years. But in the meantime, AT&T Wireless is an option for companies that want a near-national network with flat-rate pricing that works across all mobile platforms. (AT&T Wireless Services, 888-328-2288, *www.attws.com.*)

The name may be new, but **BellSouth Intelligent Wireless Network** is actually one of the nation's oldest wireless data networks. Formerly known as the RAM Mobile Data Network, BellSouth is based on Mobitex, a wireless technology dating back to 1989 that today covers 93 percent of U.S. business centers—more than any other service—at speeds of up to 8 Kbps.

Wireless Networks At a Glance

AT&T Wireless	Starts at $54.99	3,000 cities*	Notebook PCs, hand-held PCs, 3Com Palm Organizers, cell phones	19.2	✓	Unlimited	✓
BellSouth Intelligent Wireless Network	$24.95 plus usage fees	93 percent of U.S. business centers	Notebook PCs, hand-held PCs, Palm VII, RIM Inter@ctive 950 Pager	8.0	✓	Limited	✓
[illegible]	[illegible]	San Francisco Bay Area, Seattle, Washington, DC, and seven major airports	Notebook PCs (Windows and Mac)	[illegible]	✓	✓	✓

* Includes interoperability agreements with other regional carriers. ** Costs an additional $5 per month.

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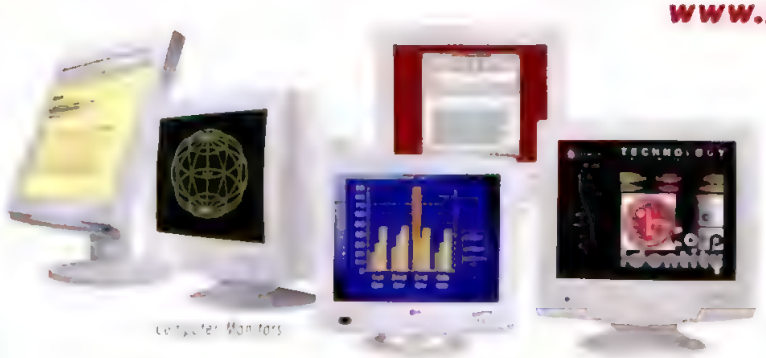

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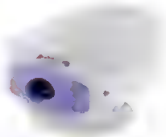

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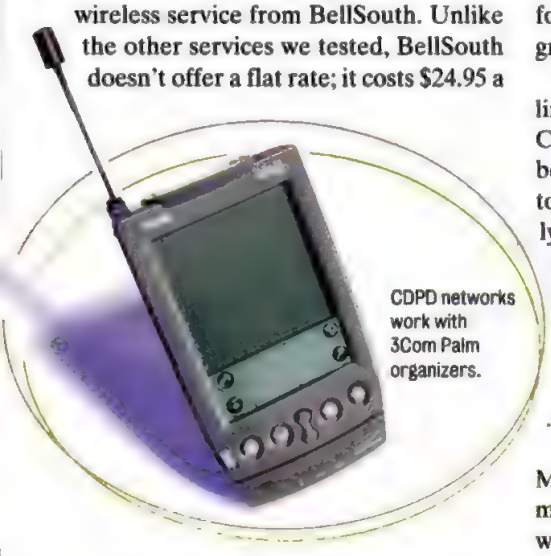
To use the network, you typically purchase a package of hardware, software, and the service from one of BellSouth's partners. For this review, we tested Infowave for Exchange, from Vancouver-based Infowave Software (*www.infowave.com*).

On the client side, the Infowave package we tested includes a Wireless PC Card modem from Research In Motion, Infowave's Wireless Engine software, and wireless service from BellSouth. Unlike the other services we tested, BellSouth doesn't offer a flat rate; it costs $24.95 a month plus fees based on usage.



CDPD networks work with 3Com Palm organizers.

We tested Infowave with a Sharp Mobilon HC-4500 Color hand-held PC, but versions are available for notebooks running Microsoft Windows 95, 98, and NT 4.0. The RIM modem for Mobitex is a standard Type II PC Card with a large plastic extension that houses a collapsible 4-inch antenna and a standard 9V battery.

Currently, Infowave is an e-mail-only solution that is tightly integrated with Microsoft Exchange. During setup, an Infowave engineer comes to your office and installs Infowave for Exchange software on your server. The company has announced Infowave for the Net, a service that will provide access to corporate intranets using both BellSouth and CDPD networks, but it wasn't ready in time for testing. GoAmerica, however, offers two wireless plans ($9.95 a month for the first 25K and $59.99 a month for unlimited use) with software that supports both e-mail and Web browsing (*www.goamerica.com*).

Although our test setup worked well, we uncovered a few annoyances. Infowave displays a pop-up window asking for your user name and password each time you connect to your mail server—even if you never exited Outlook. Second, even though our test site was just a few hundred yards from a BellSouth tower, we found the exact positioning of the unit greatly affected performance.

Although BellSouth was previously limited to notebook and Windows CE–based devices, the company has been expanding the network's presence to include smart pagers and, most recently, the 3Com Palm VII. Ultimately, BellSouth Intelligent Wireless Network will probably find more success in these markets than it has as a general wireless data solution (BellSouth Wireless Data, 800-726-3210, *www.bellsouthwd.com.*)

Of the three services we tested, only Metricom's **Ricochet** comes close to modem connection speeds without the wire. But there's a catch. Ricochet service is available only in select areas including the San Francisco Bay Area, Seattle, and Washington D.C. If you work in one of these areas, you'll find that Ricochet offers relatively fast wireless e-mail and Internet access at a reasonable, flat-rate price. The Ricochet service costs $29.95 a month, plus a $45 activation fee, or $299 for one year. But to use it, you must have a Metricom modem. We tested the service with the Ricochet SX modem ($299 list), which is about the size of a checkbook and 0.4 inches thick. (Metricom doesn't currently offer a PC Card modem.) You connect the 10-ounce modem via a serial port and affix it to the side of your hand-held PC or notebook PC with an included Velcro strip. A slim nickel hydride battery fits neatly inside, providing a rated 6 hours.

Ricochet uses its own external modem.

Metricom includes setup software and instructions for both Windows 95 and Windows CE; software for other operating systems (Windows 98, Windows NT 4.0 Workstation, MacOS, and Palm OS) is available on the company's Web site. To install the modem, simply select the included Windows driver, configure dial-up networking and you're up and running more easily than with a typical ISP.

In general, we were satisfied with the performance. The initial connection takes only a second, and throughput was sufficient for e-mail and even for relatively simple Web pages consisting mainly of text. But things began to grind to a halt when we browsed more graphics-intensive pages, with average throughput during testing of about 20 Kbps to 30 Kbps.

Metricom is aggressively expanding its coverage area and enhancing the network. The company has plans for service in 46 cities by the end of next year at speeds up to 128 Kbps. If Metricom can pull it off, Ricochet will be a must-have for those who want Web access wherever and whenever. (Metricom Inc., 800-469-4735, *www.metricom.com.*) PC

PC LABS SCORECARD

AT&T Wireless IP (CDPD)	Excellent	Excellent	Excellent	Poor
BellSouth Intelligent Wireless Network	Excellent	Good	Fair	N/A
Ricochet	Good	Fair	Good	Good

N/A—Not applicable; Infowave, the solution we tested, did not have this feature.

HOW WE TESTED

We performed our tests of wireless wide-area networks (WANs) in three areas of the country: New York, the San Francisco Bay Area, and Florida. Metricom's Ricochet was available only in the San Francisco Bay Area.)

Each tester completed a script designed to gauge the wireless data solution's setup, e-mail, and Web-browsing capabilities and its throughput for downloading ASCII and Word files. Because network access and speed varied widely depending on the exact

—Dana Jacobi

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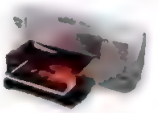

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- 40X Max[5] Variable CD-ROM Drive
- Yamaha XG 64V Wavetable Sound
- MS Office 2000 Small Business plus Bookshelf 2000, McAfee VirusScan
- MS Windows 98 Second Edition
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- 3-Year Limited Warranty[2]
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- MS Windows 98 Second Edition
- Logitech FirstMouse+ Wheel (PS/2v)
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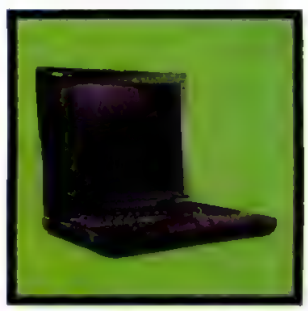

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- 64MB SDRAM
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- Modular 24X Max[7] Variable CD-ROM and Floppy Drive
- NeoMagic® MediaMagic™ 256AV AGP Video
- 3D Surround Sound with Wavetable
- Lithium Ion Battery
- Internal 56K Capable[11] v.90 Fax Modem with Trial Offer ConnectDirect Internet Access[14]
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- 3-Year Limited Warranty[2]

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- Intel Celeron Processor at 366MHz
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- 64MB SDRAM (512MB Max[13])
- 4.8GB[4] Ultra ATA Hard Drive
- Modular 24X Max[7] Variable CD-ROM
- Modular Floppy Drive
- MagicMedia 256ZX
- 3D Surround Sound with Wavetable
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DELL NOTEBOOK AWARD INFORMATION

- Inspiron 3500 C300XT – *PC World*'s Best Buy in the budget category, 6/99, 7/99.
- Latitude CPi A366XT – *PC World*'s #1 Best Buy Power Notebook, 6/99.
- Latitude CPi Series A366XT– May *Windows Magazine* List Fastest Performance, 5/99.
- Inspiron 7000 A366LT – *PC World*'s Top 10 Power Notebooks, 4/99.
- Latitude CPi Series 366XT – 5-Time Survivor of *PC Computing*'s Annual Torture Test, 3/99.
- Latitude CPi Series D300XT – *PC Computing*'s #1 Best Buy Power Notebook, 3/99.
- Inspiron 7000 A366LT – *PC Magazine*'s Editors' Choice for small businesses, 2/99.

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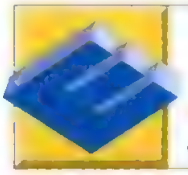

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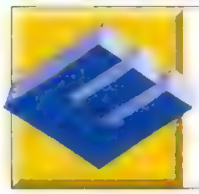

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- Integrated PCI Ultra-2/LVD SCSI Controllers
- 6 Expansion Slots: 5 PCI, 1 PCI/ISA
- 4 Hard Drive Bays: 2-1.6" and 2-1"
- Media Bays: 3-5.25"
- 3-Year NBD On-site[3] Service
- 7x24 Dedicated Server Hardware Telephone and Online Technical Support

★ *Microsoft Windows NT Server 4.0 (10 Client Access Licenses), add $799.*

★ *Upgrade to 128MB 100MHz ECC SDRAM, add $122.*

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- *PC Computing*'s "The 'A' List" – Dell PowerEdge 6300, 11/98.
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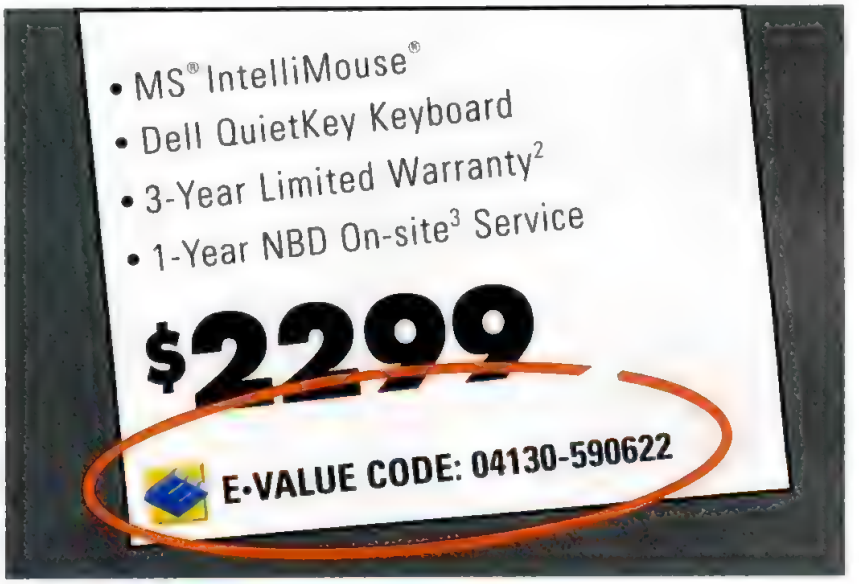

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Palm-Size PCs

By Bruce Brown

On the go and need to keep contact information, appointment calendars, to-do lists, and notes with you all (or at least most) of the time? You'll find a wide selection of useful devices in the palm-size computing category. Whether you choose a model based on Palm Computing's Palm OS or Microsoft Windows CE, you can use these handy machines to access e-mail, to retrieve data, and for limited Web browsing. While no current palm-size PC gives you the same level of Internet connectivity features enjoyed with notebook and desktop PCs—such as wide bandwidth and full-screen Web browsing with support for multimedia plug-ins—they're gaining fast.

Palm OS and Windows CE devices integrate handwriting recognition and miniature virtual keyboards, both appropriate only for minimal data entry and editing. The Palm devices, from the original PalmPilot through the slimmed-down Palm V, have won a multitude of fans by simplifying the information-handling chores many people perform several times a day. The Palm VII, a brand new model, has an integrated wireless radio for Internet e-mail and Internet data access through the BellSouth Intelligent Wireless Network (reviewed in this issue's "Wireless Data Solutions"). Simple operation through a sleek interface, fast data handling, month-long battery life, and broad third-party application support are cornerstones of the Palms' success.

The Windows CE palm-size PCs benefit from a Windows-like interface, higher screen resolution, and more standard applications and utilities than the Palm models, but have shorter battery life (averaging 6 to 20 hours, depending on the model), generally slower performance because of the added OS overhead, and a more cluttered interface. Where Palm organizers offer simplicity and focus on a few tasks as their prime virtues, Windows CE palm-size PCs promise increased functionality. All Windows CE devices, for example, have integrated voice recorders.

3Com Palms are known for their simple, uncluttered interface.

Beyond their at-hand functionality, palm-size PCs use serial cable connections, often with small docking cradles, to link to host PCs and let users synchronize changes to PIM data. There are also options for syncing your e-mail and calendars with a Lotus Notes client, though your company's server client will require permission from the server to gain access. (For more on synchronization, see "Universal Synchronization Software," in this issue.)

In addition, palm-size PCs can connect to the Internet or a network using several standard and optional methods, such as telephone modems, wireless radio modems, and modems in cellular phones. A standard CompactFlash (CF) Type II slot in Windows CE palm-size PCs can accommodate recently released CF modems. We tested the units using the Pretec 56K Fax/Modem card ($200 street) and the Socket Communications Low Power Ethernet Card ($130 street). The smart choice in wireless solutions right now is one of the Palm units. In addition to the Palm VII's unique built-in connectivity capabilities, Novatel Wireless Minstrel CDPD modems add wireless connectivity to most other 3Com models.

Currently there are no CDPD solutions for the Windows CE–based palm-size PCs. With a Windows CE device, however, you can use the infrared port to connect to a GSM (digital) cellular phone and then use the phone's modem to link to the Internet. We used an Ericsson CF888 GSM phone with the Windows CE palm-size PCs and found the connection reliable. The only inconvenience is that each time you turn on the phone you have to enable infrared connectivity. But otherwise, you simply hold the devices with the infrared transceivers lined up and make the connection. Once you've established an Internet connection on a Palm OS or Windows CE device, you can use a program such as AvantGo, Conduit PalmBrowser (both free downloads), or SmartCode HandWEB (Palm OS only, $49.95 list) to download Web pages complete with graphics.

So, whether it's for keeping important phone numbers on hand or receiving e-mail on the road, one of the nine devices we tested may be just what you need.

Casio has hit on something special with the new **Casio Cassiopeia E-100** ($500 street) and soon-to-be-released E-105 ($600

PROFILE

ANATOLE D. RUSLANOV

• *Spiritual Director and CEO, Abhidyan Yoga Institute Inc.*

Anatole D. Ruslanov is a spiritual leader for the nineties. The former monk and CEO of the Abhidyan Yoga Institute, Anatole has traveled the world—Cyprus, Egypt, Germany, Greece, India, Israel, Turkey, the U.K., and Yugoslavia—teaching weekend-long yoga workshops. And every step of the way, he has carried a notebook PC—or eight notebooks, to be precise. His current machine is a Toshiba Tecra 8000 with a built-in Iomega Zip Drive—great for making backups and keeping lectures on tantric philosophy and the origins of life handy. Anatole uses Microsoft FrontPage 98 to maintain his institute's Web site and when he's not working, he's behind the wheel of Microsoft Flight Simulator. His tip for fellow travelers: Expect the unexpected when you travel, and always have a disaster recovery plan.

"I caution other people about new technology, but then I always get the new thing right away. Take Microsoft Office 2000. I know it will be full of minor, irritating bugs, but I can assure you I will have the package installed as soon as it is available."

street) palm-size models. The performance, display quality, and stereo audio output of the E-100 make it a standout.

The secret of the Cassiopeia's likely success is not related to connectivity, however, but to its superior multimedia capabilities. Like several other Windows

HP offers an add-on keyboard for the Jornada 420.

CE units, the 9-ounce Casio models have color, 240-by-320–resolution displays—but the Casio devices are the only ones with 8-bit, 65,536 color support. Only the Casio models output stereo audio through their headphone jacks. The E-100 and E-105, each equipped with a 131-MHz NEC VR4121 MIPS CPU, have 16MB and 32MB of RAM, respectively, for added program and data file storage. The rechargeable lithium ion battery is rated at 6 hours between charges.

With support for MP3 and other music file formats, bundled Audible MobilePlayer, Sierra Imaging's Image Expert CE software to display digital images, and an optional multimedia software bundle ($70 street) that converts desktop AVI and MPEG-1 video files to play on the palm-size platform, Casio takes the Windows CE platform far beyond mere PIM handling. The standard CompactFlash Type II slot on the top of the E-100 can be used for third-party CF memory cards to store music, talking books, images, video, or even additional applications and data. To connect to the world, third party products, including the Pretec 56K Fax/Modem card and the Socket Communications Low Power Ethernet Card, can also use the CF slot. The E-100 was the fastest of the tested palm-size units for POP3 e-mail uploading and downloading using the Pretec modem; the fast result likely a combination of fast CPU speed and generous memory. (Casio Inc., Dover, NJ; 800-836-8580, 973-361-5400; *www.casio.com/e100.*)

The enterprise and mobile professional market orientation of the **Compaq Aero 2100** ($450 street) is evident in the choice of bundled software, which includes the Compaq Asset Viewer, CF Backup, Flight Scheduler, Expense Tracker, Dictionary Tools, and Speech-Command Recognition. The 9.4-ounce Aero 2100 also comes with Audible MobilePlayer software and includes a lithium ion battery rated for 8 to 10 hours between charges. In modem testing with the Pretec CF modem, the Aero 2100 connected well and had the second-fastest POP3 e-mail upload and download times.

To enhance outdoor viewing of its color display, the palm-size Aero 2100 uses a special TFT screen also used by Everex's very similar color display model (not reviewed for this story). The Aero 2100 is powered by a 70-MHz NEC VR4111 CPU and includes 8MB of RAM (a 16MB version is available for $500 street). The Aero 2100's 320-by-240–resolution screen with three brightness settings supports 256 colors and is easily the most viewable we tested in daylight (though less impressive indoors).

The Aero 2100 doesn't have stereo audio output, but its audio output jack supports a microphone, making the Aero 2100

The Compaq Aero 2100's audio output jack has microphone support for voice recording.

particularly convenient for recording and listening to audio memos; in testing, the sound was very clear. Another differentiating feature is a vibration alert mode—which lets you set appointment alarms without concern for annoying others.

If you travel outside often, and if you make particularly heavy use of voice recorders, the Compaq Aero 2100 is a solid choice. (Compaq Computer Corp., Houston; 800-345-1518; *www.compaq.com.*)

Everex Systems didn't provide a 540 color-display palm-size PC for this article because of limited availability, but did send a monochrome **Everex Freestyle A-20 Executive** model ($400 street) that includes 16MB RAM and a 33.6K modem built into the docking cradle. The A-20's

Stereo audio output helps make the Cassiopeia a standout.

240-by-320–resolution display is backlit and reasonably viewable in room light but provides less contrast in sunlight. The A-20 is powered by a 66-MHz NEC VR4111 MIPS CPU and has a vibrating alarm mode. At 5.3 ounces, the Everex is the lightest of the tested palm-size Windows CE devices. Battery life is rated at 7 to 10 hours, using standard rechargeable nickel hydride triple-A batteries.

Modems often consume a significant amount of portable and palm-size PC battery power, but the 33.6K modem in the A-20's docking cradle has its own battery compartment for two included double-A nickel hydride rechargeable batteries. The docking cradle, which folds for easy transport, also has built-in battery-recharging capability. With the standard AC adapter, you can recharge the triple-A batteries in the A-20 itself and the double-A batteries for the modem. For purposes of comparison, we timed POP3 e-mail uploads and downloads using the Pretec 56K CompactFlash modem with the A-20. The A-20 had the slowest times of the tested palm-size PCs, but the differences were not great and

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KEEP IT ALL TOGETHER

Hand-held devices such as PDAs are designed to keep you better organized and to free up your time to focus on more important tasks. But keeping them up to date could easily turn into a time-waster, especially if you use multiple devices. Synchronization software is designed to alleviate this problem.

All these synchronization tools can be divided between two broad categories: universal software that works with a range of devices and PIMs, and more specialized tools that are designed to work with a particular type of device (a cell phone, for example) or with different applications such as Lotus Notes or even with the Web.

UNIVERSAL SYNC

CompanionLink works with the broadest range of hardware devices. This little utility—it fits on a single floppy disk—includes a wizard to walk you through the synchronization process. We recommend the Professional version, which includes a Category Manager that lets you map categories and even applications separately so that you can, for example, sync different parts of your database with both Microsoft Outlook and GoldMine at the same time.

Although Desktop to Go 2.501 is a little more limited in terms of device and applications support, it has many features that will be attractive to users of 3Com Palm organizers. For instance, Desktop to Go installs in a flash, and it uses a simple tabbed dialog box (à la Lotus Organizer) for address book, memos, to-do list, and calendar items.

Intellisync comes in two flavors designed for the Palm OS and Windows CE. Each works with a wide variety of PIMs, as well as messaging products (Lotus Notes and Novell GroupWise) and sales force automation software. Each synchronization set appears as a separate icon, making it easy to manage multiple hand-held devices and applications. And Intellisync gives you complete control over synchronization.

WeSync uses the Web to keep you in sync with colleagues, friends, and family.

Designed originally for the Franklin Rex PC Companion, TrueSync is now a sort of synchronization environment that aims to work with all hand-held devices and applications. To add support for a new device or application, you simply download the appropriate, free TrueSync Plus Accessor. Like Intellisync, TrueSync provides graphical representations of all your connected devices and software.

SPECIALIZED TOOLS

Cell phones aren't just for making calls anymore. Most phones now include PDA-like software that lets you store information about contacts. But entering all that information on a tiny telephone keypad can be tedious, and besides, once you enter it, how do you ensure that it remains up to date? Enter FoneSync ($40 street, plus connectivity kit) from Paragon Software.

FoneSync provides a bidirectional link between your desktop PIM and any one of dozens of cell phone models from Alcatel, Ericsson, Mitsubishi, Nokia, Orbitel, Panasonic, Siemens, and Sony. With FoneSync, you can simply drag and drop contacts from Symantec's ACT!, GoldMine, Lotus Notes, and Microsoft Outlook directly into your cell phone. FoneSync also supports the emerging vCard standard. (Paragon Software, San Jose, CA; 408-558-7962; *www.paragonsoftware.com.*)

Just because your company relies on Lotus Notes for messaging doesn't mean you have to carry a laptop everywhere to stay up to date. With Lotus EasySync for Notes, ($68 list) you can synchronize the Notes calendar, contacts, tasks, memos, and e-mail with your 3Com Palm organizer or IBM WorkPad.

Keeping a low profile, EasySync integrates directly with Palm's HotSync 2.0 (or later) synchronization utility. We tested EasySync with a Palm III and Notes Release 4.5.2. Appointment alarms, custom contact fields, and repeating events all made the trip to the Palm III without a problem. (Lotus Development Corp., Cambridge, MA; 800-872-3387, 617-577-8500; *www.lotus.com.*)

The award for most innovative utility goes to PlusFactor's WeSync, the only product using the Internet to create a synchronization service for groups rather than for individuals. WeSync takes HotSync a giant step farther, automatically synchronizing data with "WeSync Communities" stored on its Internet-based server. Once the data is uploaded, others can access it from a desktop PC or by downloading it to their own Palm organizers.

WeSync is designed both for business users and for consumers. Communities are divided into three main areas: Your Work Life, Your Personal Life, and Your Interests. In each of these, you can store sets of calendars and contacts. Although it was not ready in time for our testing, WeSync should be available this fall. Pricing has not been set, but PlusFactor plans to offer the service free for the first 90 days. (PlusFactor Software Inc., Portland, OR; 503-827-6717; *www.plusfactor.com.*)—*By Stephen W. Plain and Maggie Overfelt*

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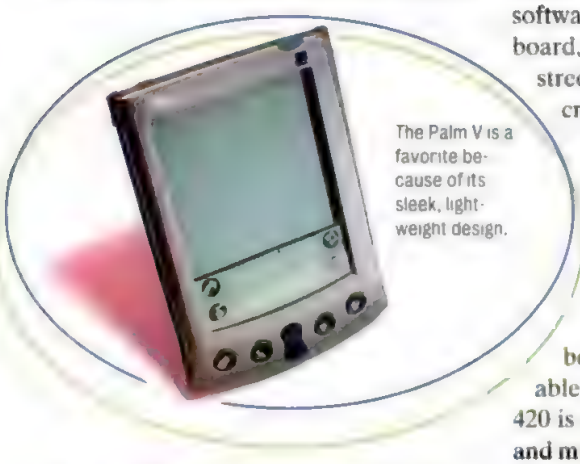
were likely due to the unit's relatively slow CPU.

The Everex Freestyle Executive A-20 lacks a color screen, but ample memory, a standard modem, and two-way battery recharging with included nickel hydride batteries make it an appealing choice. (Everex Systems Inc., Fremont, CA; 888-725-6724; *freestyle.everex.com.*)

The **HP Jornada 420** ($520 street) is the only color-display-equipped Windows CE palm-size PDA we tested that has a passive-matrix LCD screen, but if you were using it indoors, you'd never know it was not a TFT display. The Jornada 420's 240-by-320–resolution, 256-color display



The Palm V is a favorite because of its sleek, lightweight design.

appeared just slightly less bright than the Casio and Philips displays in room lighting, and was average in outdoor light. There are 11 display adjustment levels each for contrast and brightness.

Encased in purple plastic with a removable clear plastic flip-up screen cover, the 9.2-ounce Jornada 420 is powered by a 100-MHz Hitachi SH-3 CPU with 8MB of RAM. Under the terms of a promotion that lasts through the end of August, HP will send you a 16MB SanDisk CompactFlash memory card, a 65,536 color display driver, Sierra Imaging's Image Expert CE software, and HP's voice contacts software when you mail in a coupon after purchasing a Jornada 420. The Jornada 420 also includes Trio PhoneManager software for managing a GSM phone book and sending and downloading short message service (SMS) messages when connecting with a GSM phone via the Jornada 420's infrared port.

In case you have to input extensive data and don't want to use the Jornada 420's standard Communication Intelligence Corp. Jot handwriting recognition software or the Windows CE virtual keyboard, HP sells an add-on keyboard ($80 street) that plugs into the Jornada 420's cradle.

In connectivity testing with the Pretec 56K CF modem, the Jornada 420 had average scores within the relatively close range of times in downloading and uploading e-mail via a POP3 e-mail account.

With added value because of its bonus accessory bundle and adjustable, bright color display, the Jornada 420 is a fine choice for a palm-size PIM and multimedia PDA. (Hewlett-Packard Co., Palo Alto, CA; 800-443-1254; *www.hp.com/jornada.*)

Philips Electronics has consistently developed attractive and user-friendly Windows CE devices. This tradition continues with the new 240-by-320–resolution, 256-color TFT display–equipped **Philips Nino 500** ($450 street), which is designed specifically for one-hand operation and includes a wide selection of input software. The Nino 500's screen is almost as bright as the field-leading Casio Cassiopeia E-100. Based on a 75-MHz Toshiba MIPS processor, the 8.6-ounce Nino 500 comes with 16MB of RAM, nickel hydride rechargeable batteries, a docking cradle, and an AC adapter.

The Everex Freestyle A-20 Executive weighs a mere 5.3 ounces.

An optional 33.6K Nino modem Click-on ($90 street) is available for the Nino 500, but for our testing we stuck with the Pretec 56K CF modem. We were not able to connect successfully to our test POP3 e-mail server with the Nino 500, however. The Nino reported that the server was responding too slowly, a problem none of the other tested Windows CE devices reported.

The Nino's left- and right-side buttons are arranged so you can manage and navigate applications one-handed. In addition to the control buttons, there are five methods of inputting data and commands, including the Windows CE–standard Jot handwriting recognition application, a tiny virtual keyboard, the NinoVoice voice command program, ParaGraph's CalliGrapher handwriting recognizer, and the Tegic Communciations Tegic T9 text input keypad.

The software bundled with the Nino 500 is unsurpassed by other vendors and includes: bFax Express, bPrint, and bTask (a utility to speed navigation), from Bsquare Corp.; Audible's Audible MobilePlayer; MobileSoft's Expense Manager; AvantGo's AvantGo; and NinoImage, a digital image viewer.

Except for the glitch in modem testing, the Nino 500 performed very well, with a much-appreciated emphasis on user comfort and control. (Philips Electronics, Campbell, CA; 800-367-8356; *http://nino.philips.com.*)

3Com's Palm Computing division currently sells four versions of the Palm connected organizer. The **Palm III** ($250 street) is a mainstream, 2MB unit with a

PROFILE

BRYAN BATEMAN

• *Systems Engineer, Perot Systems Corp.*

"The Palm is a device I can't live without. Aside from its basic functions, I use the Palm III to collect data, track my hours, and, of course, play games."

As a systems engineer for Michigan-based Perot Systems Corp., Bryan Bateman is on the front line of the Y2K battle, traveling to clients' manufacturing and assembly plants in Europe and Mexico to conduct Y2K assessments. On these monthly trips, Bryan always brings along his Dell Latitude CPI notebook PC—complete with PC Card modem and 10/100 Ethernet card—and a cell phone. But his most important tool is a 3Com Palm III organizer, which includes a custom application that lets him conveniently capture inventory data as he performs on-site assessments. His suggestion for business travelers: Find luggage that rolls, is well-built, and has a hookup to hold your laptop.

backlit LCD. The **Palm IIIx** ($370 street), a power-user model, boosts memory to 4MB Intended for executives with its sleek, lightweight design and rechargeable lithium ion battery, the 2MB **Palm V** ($450 street) uses a similar display. The new model, the **Palm VII** ($600 street, plus a minimum $10 monthly carrier fee) is a 2MB unit with the new display intended specifically for wireless e-mail and data access via the BellSouth Intelligent Wireless Network. Optional external modems are available for all Palm models (street prices range from $120 to $170 depending on the model), and Novatel Wireless sells CDPD wireless modems ($450 street, plus monthly carrier charges) for the Palm III and IIIx.

Compact programming and the data formats of the Palm OS make the most of a Palm PDA's memory, so that even the 2MB models can hold data for thousands of contacts, memos, tasks, and appointments. In addition to synchronizing data via serial cable, you can also share data between Palm devices via infrared beaming within a one-meter distance—a convenient process. For inputting text, standard methods include Graffiti handwriting recognition software and a miniature virtual keyboard. Optional third-party handwriting recognizers and Tegic's T9 Text Input fast data entry software are other choices. The Palm III and Palm IIIx plug into the LandWare GoType! keyboard ($80 list) for more comfortable typing.

All Palm models use a four-gray-scale 120-by-160 screen, limiting the amount of text or graphics you can see at one time. When used with Novatel's Minstrel with CDPD wireless service and Internet browser software such as HandWEB, the Palm screen is best for text-based content both because of relatively low bandwidth and limited graphics support. You can see graphics on the Palm models using third-party browsers or software such as AvantGo to download Internet graphics and convert it to gray scale, but text content is faster and more usable.

The Palm IIIx adds 2MB of memory to the Palm III model.

The Palm V is the flagship conventional Palm model, even though at 2MB it has only half the memory of the Palm IIIx. The Palm IIIx and V both run Palm OS 3.1, which adds a conduit for synchronizing PIM data with Microsoft Outlook on host PCs. The 4.4-ounce Palm V has a 0.45-inch-deep anodized aluminum case, and although it's the most costly traditional Palm PDA (that is, one without a wireless radio), the more compact size and lower weight are attracting users who seek ever-more-convenient digital accessories and who prefer the long-term savings of rechargeable batteries. An optional clip-on 33.3K external modem ($170 street) attaches to the back of the Palm V for communications, but as of publication date, no vendor has yet announced a wireless modem for this model.

The Palm VII is Palm Computing's entry into wireless PDA connectivity. Currently available for sale only in the greater New York metropolitan area, the Palm VII will be sold nationwide later this year. The Palm VII is a highly integrated device, combining a PDA, an 8,000-bps wireless radio, a service connection with the BellSouth 900-MHz Mobitex protocol network, and application software for handling e-mail messages and for accessing data from special sites on the Internet. Whether the market will support a $600 PDA with a minimum $10 monthly service charge and nonstandard Internet content remains to be seen, but Palm Computing deserves a lot of credit for the product integration and very easy start-up and connection routines. As with pagers and cell phones, various service plans are available depending on Palm VII usage.

Once you've established an account, e-mail messages and data inquiries route through the Palm network system, with most responses during testing taking just a few seconds. You can't browse the Internet or retrieve full Web pages with the Palm VII but instead use a process called *Web clipping*. To clip, you send specific inquiries to content providers such as ABC News, ESPN, Etak, E*Trade, Fodors Travel Online, Moviefone.com, and The Weather Channel to receive information or conduct transactions. (Palm Computing Inc., Mountain View, CA; 800-881-7256; *www.palm.com*.)

Whether they're used to pass business card information via infrared beaming, to synchronize appointments with PCs, or to make dinner reservations wirelessly, the Palm Computing palm-size PCs underscore the value of simple, easy connectivity.

Connect Anywhere

Hand-Held PCs

By Bruce Brown

Hand-held PCs deliver impressive function in superportable form, and they're essential for frequent travelers—whether cross-country or cross-town—who need more computing power than a palm-size PC can provide.

Windows CE–based models ease data entry and editing thanks to their notebook computer–like keyboards; and their screens—larger than those of palm-size models—can display more content. Don't expect your hand-held PC to replace your notebook computer. Hand-helds can't run full versions of application software and they lack internal hard disks. But thanks to internal storage that uses static memory rather than a spinning hard disk, they offer longer battery life, less bulk, and greater durability.

Hand-helds won't give you a full Web-browsing experience. Although the current version of Pocket Internet Explorer is compatible with Microsoft Internet Explorer 3.0 for Windows OS, it doesn't support Java or frames. All hand-helds have serial and infrared ports, many have dedicated ports for external monitors, and a few have dedicated printer ports. Some of the larger models even include USB ports. Single Type II CompactFlash slots are standard, and all but a few early models from Philips Electronics have Type II PC Card slots. Internal modems abound, typically rated at 33.6K or 56K.

For wireless connectivity, there are several options on the market, including PC Card CDPD modems from Novatel Wireless, Sierra Wireless, and others. (For more on wireless connectivity, see "Wireless Data Solutions.")

The **Compaq Aero 8000** ($1,000 street), Compaq Computer Corp.'s first hand-held, is a strong contender. Clearly intended for corporate more than for personal use, the Aero 8000 combines an impressive number of connectivity features in a trim design.

The HP Jornada 820 features a touch pad pointing device.

Powered by a 128-MHz Hitachi SH-4 CPU, the 1- by 10.8- by 8.5-inch (HWD), 2.9-pound Aero 8000 comes standard with 16MB of SDRAM, a backlit, 10-inch-diagonal, 800-by-600–resolution, 256-color screen, and an internal 56K modem. Though the screen is sufficiently large, we were slightly disappointed to see that it is dual-scan passive-matrix, not TFT.

The Aero 8000 eschews a touch screen in favor of a more traditional pointing device—in this case, a touch pad. The 18-mm key pitch compares favorably with those of other hand-held models and nearly equals the 19-mm spacing used in conventional keyboards. The Aero 8000 augments its large screen and keyboard with a single Type II PC Card slot, two CompactFlash slots, and an internal smart-card reader and writer with a standard 3K smart card to control access. Standard lithium ion batteries are rated for up to 7 hours between charges—lower than the 8- to 16-hour ratings on the other devices we tested.

A wide variety of productivity and connectivity software is bundled with the Aero 8000, including Audible MobilePlayer, Applian Technology's CoolCalc, Inso's Quick View Plus (a three-time Editors' Choice winner), Westtek's PowerPoint editor, fax software, and an expense tracker. For synchronizing with mail servers, the Aero 8000 includes River Run's Mail on the Run! and All in Sync!, and connections with servers are assisted by Citrix ICA CE client software and terminal software from FutureSoft.

The Aero 8000 looks more like a very thin notebook PC than like a PDA, and the advantages of its fast CPU and memory technology paid off on our connectivity tests, in which the Compaq excelled when connected by modem or Ethernet network connection. (Compaq Computer Corp., Houston; 800-345-1518; *www.compaq.com.*)

The 1.1-pound **HP Jornada 680** ($900 street) has a 6.5-inch-diagonal half-VGA color touch screen, and the **HP Jornada 820** ($1,000 street) is an 8.2-inch-diagonal, full-screen, VGA-based model that weighs 2 pounds 10 ounces and resembles a small notebook, complete with a touch-pad pointing device. While the two HP units are intended for different markets—the Jornada 680 for mobile professionals and the Jornada 820 for enterprise applications—both are rugged devices with powerful CPUs and internal modems.

The 1.3- by 7.4- by 3.7-inch (HWD) Jornada 680 is based on a 133-MHz Hitachi

PROFILE

MARTIN BACHMANN

• *Owner, Backmann Ings. SA*

"I like to travel. Staying at home or in the office would be boring. I don't know anyone in Peru as well-equipped as I am. My competitors try to match me, but they can't beat me. I work alone, and have captured 85 percent of the market."

Our tests are tough on notebook PCs, but Martin Bachmann's business travel is a true torture test. Since starting his own company, Bachmann Ings., in 1994, Martin has been traveling to remote areas of Peru selling hydraulic torque wrenches to fishing, mining, and power companies. Although he is currently using a Toshiba notebook, Martin has yet to find any notebook PC that can survive, unscathed, altitudes of up to 15,000 feet, rutted roads, 99 percent humidity, and temperatures that range from freezing to boiling. Other tools that can be found in his Samsonite Pilot bag include a digital video camera, a video capture card, a Pentax pocket printer, a cell phone, and a Franklin Rex PC Companion. His advice to other travelers: Enjoy the trip, and don't despair if it takes a while for the orders to roll in.

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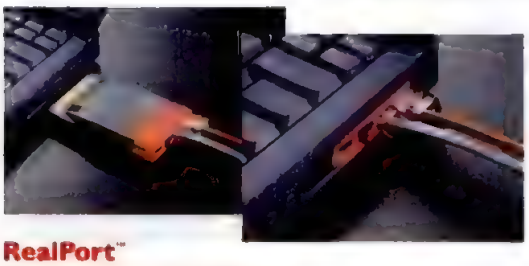

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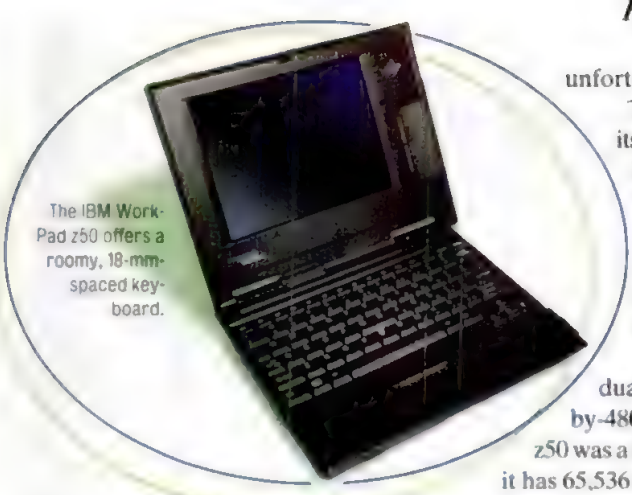

The IBM WorkPad z50 offers a roomy, 18-mm-spaced keyboard.

SH-3 processor with 16MB of ROM and 16MB of SDRAM. The keyboard has 14.5-mm key spacing, making it almost comfortable for a moderate amount of typing The Jornada 680's screen is bright and responsive, and the rechargeable lithium ion batteries are rated for up to 8 hours of use between charges.

The Jornada 680, like the 820 model, has an internal 56K V.90 modem and single Type II PC Card and CompactFlash slots. In connectivity speed testing both Jornadas performed without a hitch, with average scores when connected by modem or Ethernet card.

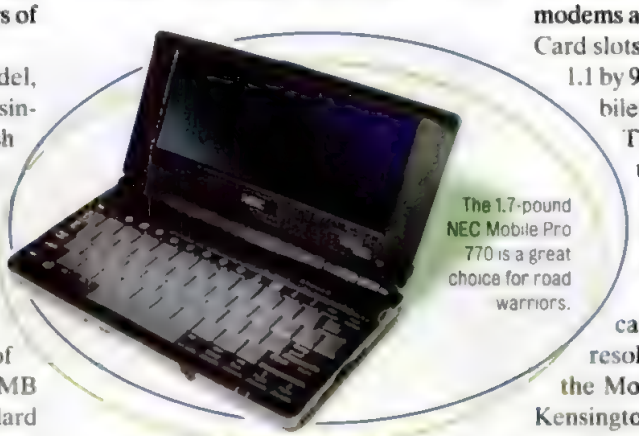
The Jornada 820 is powered by a 190-MHz Intel StrongARM processor and comes standard with 16MB of RAM (upgradable to 32MB) and 16MB of ROM. In addition to the near-standard Type II CompactFlash and PC Card slots, the Jornada has a USB port and 15-pin XVGA-out port for connection to an external monitor. The Jornada 820 measures 1.3 by 9.7 by 7.0 inches (HWD), is rated to run for up to 10 hours on a fully charged lithium ion battery, and offers relatively generous 17-mm key spacing.

The Jornadas are solid choices, and especially the Jornada 680 if you subscribe to the "smaller is better" theory of computing. (Hewlett-Packard Co., Palo Alto, CA; 800-443-1254; *www.hp.com/jornada.*)

IBM's first Windows CE device, the **IBM WorkPad z50** ($1,000 street) is powered by a 131-MHz NEC VR4121 MIPS processor and equipped with 16MB of RAM standard. The 1- by 10.2- by 8-inch (HWD) z50 weighs 2.7 pounds with its standard 8-hour–rated lithium ion battery installed. The z50 has a Type III PC Card slot that is unique in this field. The internal modem is unfortunately limited to 33.6 Kbps.

The best features of the z50 is its notebooklike 18-mm-spaced keyboard complete with TrackPoint pointing device and bundled IBM Mobile Connect client software for easy corporate network e-mail configuration.

The 8.2-inch-diagonal, dual-scan, passive-matrix, 640-by-480–resolution display on the z50 was a disappointment, even though it has 65,536 color support and extremely easily adjustable contrast and brightness buttons. The screen is small, relative to the size of the z50's lid, and the passive-matrix display pales next to the brighter TFT screens on several of the other hand-helds. You can get used to the way the screen looks, but in testing we also found that the screen couldn't always keep up with the cursor as we moved it around, a noticeable annoyance.


The 1.7-pound NEC MobilePro 770 is a great choice for road warriors.

In addition to the easily set up corporate e-mail software, the z50 is bundled with the IBM Global Network Dialer, Microsoft Expedia Pocket Streets 98, and Bsquare Corp.'s bPrint, bFax, and bUseful software.

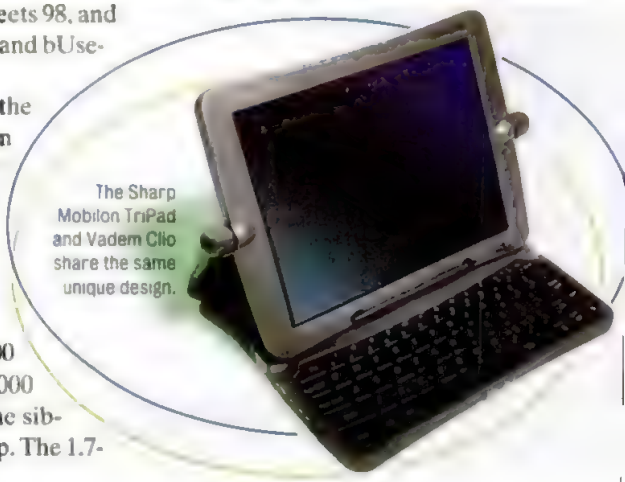
On our connectivity tests, the z50 had average scores when connected by modem and slightly below average scores overall when connected by Ethernet. (IBM Corp., Armonk, NY; 800-426-7255; *www.ibm.com/pc/us/workpad.*)

The **NEC MobilePro 770** ($800 street) and **MobilePro 800** ($1,000 street) are more alike than the sibling models from HP and Sharp. The 1.7-pound MobilePro 770 has an 8.1-inch-diagonal, 65,536-color, half-VGA, 640-by-240–resolution touch screen while the 2.6-pound MobilePro 800 has a 9.4-inch-diagonal, 65,536-color, 800-by-600–resolution display. NEC positions the MobilePro 800 for enterprise applications because its screen displays a lot of data and the MobilePro 770 for road warriors who need greater mobility, but both devices have found converts in many arenas because of their fast, bright screens, better-than-average keyboards, and useful software selections.

Both MobilePro models are based on 131-MHz NEC VR4121 MIPS 32-bit RISC CPUs and come standard with 24MB of replaceable ROM and 32MB of RAM. Each has a 78-key, 17.5-mm-pitch keyboard with ten programmable function keys. Other common features include internal 56K modems and the usual Type II CF and PC Card slots. The MobilePro 770 measures 1.1 by 9.6 by 5.2 inches (HWD); the MobilePro 800, 1.1 by 9.6 by 7.5 inches. The standard lithium ion batteries used in the two NEC models are rated for up to 8 hours per charge in the MobilePro 800 and 10 hours in the 770.

In addition to having a larger case and greater internal display resolution than the MobilePro 770, the MobilePro 800 adds a USB port, Kensington security system slot for third-party locking cables.

Software bundled with the MobilePro, includes Bsquare's bFax, Jetcet PowerPoint Companion editing and printing software, Connect Force Internet Connection Wizard, and Puma Technology's Intellisync for Act! and Lotus Organizer.


The Sharp Mobilon TriPad and Vadem Clio share the same unique design.

The Vadem Clio is nearly identical to the Sharp Mobilon Pro PVC-5000.

On modem and LAN connectivity tests, the MobilePro devices had similar but not identical performances, attaining average scores overall. (NEC Computer Systems Division, Mountain View, CA; 888-863-2669; *www.nec-computers.com.*)

The two models from Sharp are significantly different, reflecting their different design and manufacturing sources. The 3.2-pound **Sharp Mobilon Pro PVC-5000** ($900 street) is an all-Sharp product with a conventional clamshell design and is based on an 129-MHz Toshiba TX 3922 CPU. The 2.6-pound **Sharp Mobilon TriPad** ($950 street), a joint design effort with Vadem and identical in hardware features to the Vadem Clio, has an intriguing and useful flip screen with side-mounted supports that let you use the device as a notepad, a presentation machine, or as a more traditional display-behind-the-keyboard machine. The TriPad is based on an 80-MHz NEC VR4111 MIPS processor, a significantly slower CPU than that of the Mobilon Pro, and the difference showed in performance testing.

Both models have 9.4-inch-diagonal, 640-by-480–resolution, 256-color VGA touch screens, 16MB of RAM, 33.6K internal modems, and single Type II CompactFlash and PC Card slots, and have identical software bundles, including Sierra Imaging's Image Editor CE, Sharp's PC File Viewer, Bsquare's bFax Pro, bUseful backup utility, Citrix ICA client, and Proxim driver for Wireless LAN PC Cards. Battery life for their internal lithium ion rechargeable batteries is rated up to 15 hours for the Mobilon Pro and 16 hours for the TriPad.

The Mobilon Pro, which measures 1 by 9.3 by 7.9 inches (HWD), had average throughput and timing scores connected by telephone modem and the fastest scores in the roundup when connected by Ethernet LAN.

The Mobilon TriPad, measuring 1.3 by 11.3 by 8.6 inches, is intended for business users, particularly those who make mobile presentations. While the TriPad's PC Card slot is easily accessible, the CompactFlash card slot is hidden behind the battery and cannot accept CF cards that extend beyond the slot. Also, the cards can only be inserted or removed with the battery taken out. The TriPad's 80-MHz CPU also held the unit back in performance testing, where the TriPad, like the Vadem Clio, had the lowest overall measured performance. (Sharp Electronics Corp., Mahwah, NJ; 800-237-4277; *www.sharp-usa.com.*)

There are no hardware differences between the Sharp Mobilon TriPad and the **Vadem Clio**, ($1,000 street), although Vadem rates the battery life as 12 hours per charge. The Clio and the TriPad had equally slow benchmark-test performances and share the unfortunate CompactFlash card-slot placement. The cool, flexible functionality of the Clio has won fans even though the device isn't a speed demon.

The three basic modes of use for the Clio are as a tablet, an easel, and a notebook. In tablet mode, the screen covers the keyboard and you use handwriting recognition for writing and taking notes using the standard Jot recognizer or ParaGraph's excellent CalliGrapher 5.2 handwriting recognition software, which can read cursive as well as printed text.

For making presentations to others using Pocket PowerPoint, you fold the Clio into easel configuration with the screen facing your audience and the keyboard facing you. In this mode, you can control the presentation progress with the keyboard while your small audience (the Clio's good for up to three or four people) can have a clear view of the screen.

In addition to CalliGrapher, other software bundled with the Clio includes Bsquare's bFax Pro and Vadem ViewFinder intelligent viewer and finder utility. (Vadem, San Jose, CA; 888-468-2336; *www.vadem.com.*) PC

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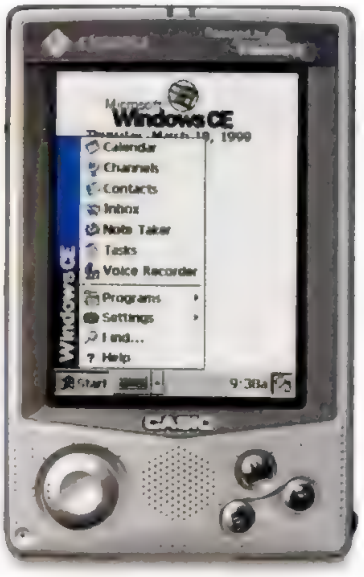

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Connect Notebook PCs

By Bill Howard

If getting connected anywhere is your goal, then you need to consider a portable PC. Notebooks have evolved from being an optional piece of hardware for an organization's few select traveling executives to an essential tool for anyone who needs to be connected to e-mail, prepare documents, or give presentations either on the road or around the office. To that end, the machines we tested for this story are evolving to fit into the connected world: Almost half now include integrated 56K modems for connecting to the Internet or to your corporate LAN via dial-up service (replacing the PC Card modems that were standard a year ago), and five machines even include built-in Ethernet ports for high-speed access to your LAN. We divided the 54 systems PC Magazine Labs tested for our annual midsummer roundup of portables into five categories based on size, performance, and price. We invited each manufacturer with a national presence to submit one product in the category of its choice; larger makers with broad lines were allowed to submit a product in each category.

Mini-notebook (4 systems). These systems weigh between 3 and 4 pounds (note that the weights we cite are for the PC plus the battery, with available drives bays filled; AC adapters typically add 8 to 16 ounces). Each runs Windows 98 and full-blown desktop applications (not the "lite" versions run on Windows CE). The trade-offs for the slight size are a scaled-down keyboard and screen and no internal floppy disk or CD-ROM drive. These systems are ideal if you want a daily companion for e-mail, word processing, and spreadsheet work.

Thin and light (9 systems). Weighing just 4 to 5 pounds, these machines deliver full-size keyboards and screens. If you travel frequently, than this is the class of notebook for you.

Mainstream (13 systems). A mainstream model is typically 7 to 8 pounds and features a 13- to 14-inch screen and (in addition to the built-in hard disk) a swappable bay for a floppy disk, CD-ROM, or DVD drive, extra hard disk, or battery. These systems are the workhorses found in corporate fleets; they are ideal for mobile presenters and other users who need a robust but relatively affordable portable.

Desktop replacement (19 systems). This class delivers high-end processors (typically a 400-MHz Mobile Pentium II), DVD drives, and large (14- or even 15-inch) displays. At about 9 pounds, you wouldn't want to carry one every day, but a machine in this category is a good choice if you need a system equivalent in power and functionality to a desktop and with the flexibility of a portable.

Value (9 systems). We set a price target of $1,500 for this category. These machines tend to be based on slower processors than any other class (save for the mini-note-

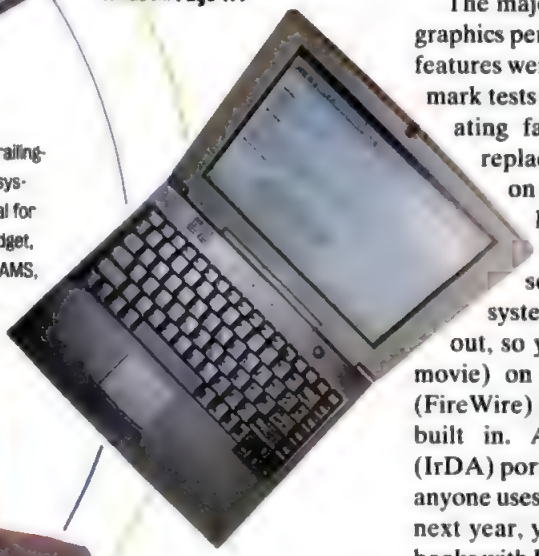
Desktop Replacement

Big screens (up to 15 inches), large hard disks, and a wealth of bays make these 9-pound beasts ready for anything. If you need the power of a desktop but want the flexibility of taking the machine with you when needed, one of these might be right for you. Apple, Brick, Compaq, Dell, FOSA, Gateway, HP, IBM, MAG, Micro Express, Micron, MidWest, NEC, Panasonic, Quantex, Sceptre, Sony, Toshiba, WinBook. **Page 185**

Thin and Light

These 4- to 5-pound machines offer full-size keyboards and screens in super slim (1-inch-thick) packages. High-powered and high-priced, they are the machines of choice for executives who travel frequently or carry a laptop daily. ALMA, Compaq, Fujitsu, Gateway, HP, IBM, NEC, Sony, Toshiba. **Page 165**

Mainstream Relatively large screens (13 to 14 inches) and moderate prices (around $2,000) make these full-feature machines the bread and butter of the market. At 7 to 8 pounds, they aren't for toting every day, but they have the power and features for the occasional business trip or presentation on the road. ACT, Acer, ARM, Compaq, Dell, FutureTech, Gateway, HP, IBM, Micron, PC Notebook, Toshiba, WinBook. **Page 179**



Value Fewer bells and whistles and trailing-edge processors keep the price of these systems low (around $1,500). But they're ideal for small businesses and home users on a budget, as well as for students bound for college. AMS, ChemUSA, Gateway, HP, IBM, NEC, Sony, Toshiba, WinBook. **Page 200**

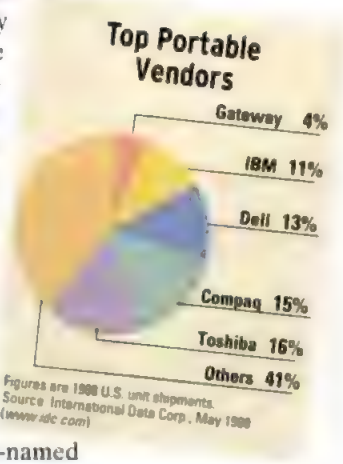
Mini-Notebook Slightly larger than Windows CE hand-held PCs, these compact 3-pound machines run Windows 98 and full-fledged Windows apps. If you want a machine you can toss into your briefcase for e-mail and word processing (and don't mind a cramped keyboard), look here. Fujitsu, IBM, Sony, Toshiba. **Page 156**

books) and generally do not offer cutting-edge features such as DVD options or docking stations. But they are perfectly capable for home, school, or small-office use.

Six of the systems have 15-inch displays. They're beautiful to behold, but do note that they add size, weight, cost, and battery drain, and they don't increase resolution. The big displays make sense if you don't travel a lot with your notebook or if you're a mobile presenter using the display rather than an LCD projector. Want more resolution? Hold off until late this year or early 2000, when we'll see 16-inch notebook panels that make the jump to 1,280-by-1,024 resolution.

The majority of systems were capable of decent 3-D graphics performance, but we were disappointed that the features weren't implemented (see the section on benchmark tests for details). Battery life is another differentiating factor. For example, some of the desktop replacement models we tested surpassed 4 hours on a single charge, but others managed only 2 hours or so.

I/O (input/output) could be a key issue for some buyers. If you're into USB, note that 11 systems have two USB ports. Also, 20 have video-out, so you can run a presentation (or play a DVD movie) on a TV. One Sony model has IEEE 1394 (FireWire) built in; the Apple G3 PowerBook has SCSI built in. All have infrared (IrDA) ports, although hardly anyone uses them. By this time next year, you may see notebooks with Bluetooth, a short-range wireless standard that could supplant infrared (discussed in the sidebar, "Bluetooth: Soon Your Devices Will Talk to Each Other").



The only thing missing from the picture this year is the Pentium III. Come September or October, Intel will release a mobile version of the processor (code-named Coppermine), probably at 650 MHz. It will be the first Intel CPU to drop from a 0.25-micron to a 0.18-micron manufacturing process (smaller die sizes use less power), and it will have two distinct power settings—desktop-challenging full power for AC operation and scaled-back performance for battery power. Because this is such a sea change, several makers may use this as the opportunity to redo their designs. But if you can't wait for those models, one in the current crop is bound to please.

PC MAGAZINE EDITORS' CHOICE

EDITORS' CHOICE

Mini-notebook: Toshiba Portégé 3020CT • Thin and light: IBM ThinkPad 570 • Mainstream: Dell Latitude CPt C400GT • Desktop replacement: Dell Inspiron 7000 A400LT, IBM ThinkPad 600E • Value: NEC Versa Note

Among the four mini-notebooks we tested, our clear favorite is the Toshiba Portégé 3020CT ($2,000). The keyboard and screen are as close to full-size as you'll find in this class, and the included port replicator adds to the machine's overall usefulness and value.

Road warriors who need a more powerful machine have several good choices and two clear winners. The IBM ThinkPad 570 ($3,100 street) is our Editors' Choice among thin and light machines. What we like best about this model is the unit's flexibility: You can use it as an eminently portable (just 4 pounds and 1 inch thick) machine, or equip it with IBM's 3-pound UltraBase module ($395), which adds two bays for the swappable floppy disk drive, CD-ROM, DVD, extra battery, and more. A second IBM, the ThinkPad 600E ($4,100), also deserves Editors' Choice honors. Though IBM submitted this notebook for our desktop replacement category (where its review appears), at just 5.6 pounds and 1.5 inches thick, it is closer to a thin and light machine than a desktop replacement. If you usually take a floppy disk or CD-ROM drive on the road, then the ThinkPad 600E is a better choice than the ThinkPad 570 plus the UltraBase.

Honorable mention for a thin and light goes to the Sony VAIO PCG-Z505SX ($3,000 street). At 1 inch thick and 3.5 pounds, the unit is as portable as some mini-notebooks, with full power and a host of ports—including an IEEE 1394 port for quick video capture.

In the mainstream category, our Editors' Choice winner is the Dell Latitude CPt C400GT ($2,097 direct). Dell has fitted a 14-inch screen into a relatively compact, lightweight (6.5-pound), and flexible package. Good performance from the Celeron 400-MHz processor and great service and support make this system even more attractive. Honorable mentions go to the Compaq Prosignia 150 ($2,350 street), which delivered great performance, and to the Toshiba Satellite 4030CDT ($1,800 street), which is a fine machine at a bargain price.

For those of you who want a unit that can serve as your only system, our Editors' Choice among the desktop replacements is the Dell Inspiron 7000 A400LT ($3,590 direct). At 9.5 pounds, this unit is not for slogging through airports, but its 400-MHz Mobile Pentium II processor, 128MB of RAM, 8MB ATI graphics subsystem, 13.4GB hard disk, and (best of all) gorgeous 15-inch screen might put your current desktop to shame.

If price is a primary concern, consider our Editors' Choice in the value category—the NEC Versa Note. Your $1,600 buys a good-performing machine with all the bells and whistles you're likely to need, plus NEC's UltraCare support, which is among the most comprehensive in the industry.

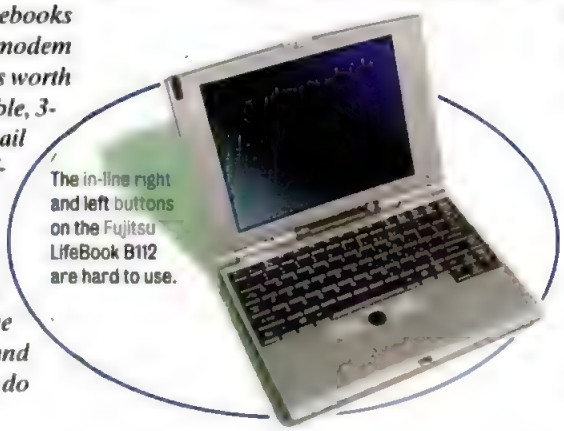
Mini NOTEBOOKS

BY M. DAVID STONE

Being able to connect anywhere with a lightweight device is fine, but what if you want the power and applications of a full-fledged laptop PC but without the weight? Consider a mini-notebook. Unlike Palm Pilot–type devices and Windows CE machines, a mini-notebook runs Windows 98 and standard desktop applications—not scaled-down "lite" versions. And all the mini-notebooks we tested included a built-in 56K modem for easy connectivity. So this class is worth considering if you need an affordable, 3-pound word-processing and e-mail companion to toss into your briefcase.

But there are compromises. A mini-notebook forces you to make do with a smaller keyboard and screen, for instance. You'll also give up some ports (such as video-in and video-out), and you'll have to make do with just a Type II PC Card slot. In their favor, all of the tested units deliver at least one USB port (the Fujitsu has two), and the Fujitsu and Toshiba models include a port replicator for full functionality.

These four systems get their small size, in part, by not integrating the floppy disk and CD-ROM drives. Each includes an external floppy disk drive, but you'll need to pay extra for an external CD-ROM drive ($250 to $300), and DVD-ROM is not an option. As a group, these units offer the slowest performance of any category of notebooks because they have slower processors, which also keep their prices relatively low.



The in-line right and left buttons on the Fujitsu LifeBook B112 are hard to use.

One of the smallest notebooks we looked at, the **Fujitsu LifeBook B112** ($1,599 direct) is built around a Pentium MMX/233 processor and weighs in at 2.8 pounds. The unit's light weight, long battery life, and convenient touch screen are enticing, but its cramped keyboard and dim screen make the LifeBook B112 a poor choice for much more than reading e-mail or browsing the Web.

The system's primary pointing device, essentially a wide, flat pointer stick, is somewhat difficult to use. Making up for this is a touch screen that proves suitably accurate, especially when

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using the included stylus. But the keyboard's 15-mm key pitch makes this unit a poor choice for touch typists intent on serious word processing. In addition, the smallish 8.4-inch display is dim compared with others.

The trade-off for a relatively dim screen is long battery life—over 4 hours on our test. Performance was in line with the other mini-notebooks included here.

The IBM ThinkPad 240 has a great keyboard.

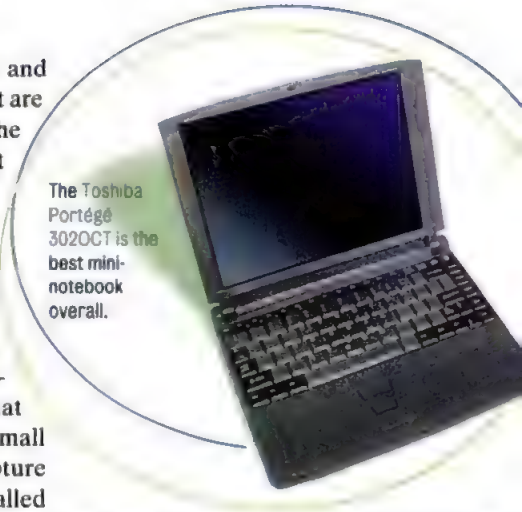
Notice, too, that the on-site service contract, at $50 per year, is somewhat higher than for other mini-notebooks, but it includes a loaner unit if needed. (Fujitsu Computer Products of America, San Jose, CA; 408-432-6333; *www.fujitsu.com*.)

At 2.9 pounds, the **IBM ThinkPad 240** ($2,000 street) is the largest and heaviest minicomputer we looked at. In that package you get a nearly standard keyboard size (18-mm pitch), and it is the only mini-notebook with a 300-MHz Mobile Celeron CPU, instead of a Pentium MMX. But there is one compromise: At just over 1 hour on our tests, battery life was disappointing.

If you like pointer sticks, the IBM TrackPoint is the best. One potential annoyance is that the Ctrl key isn't where you would find it on a standard desktop keyboard's layout. Instead, it's been moved to the right. The ThinkPad 240 was easily the best- performing mini-notebook, scoring first place on every test. The credit goes to both the 300-MHz Celeron CPU and the minimum 64MB of RAM, compared with the 32MB of RAM in the Fujitsu and Toshiba systems. Service and support are standard for the category, but the ThinkPad 240 itself is anything but standard fare. (IBM Corp., Armonk, NY; 800-426-7255; *www.ibm.com*.)

The **Sony VAIO C1 PictureBook** ($2,300 street), built around a Pentium MMX/266, is a close match in size for the Fujitsu unit: At 2.4 pounds, the PictureBook is the lightest computer we looked at. But what distinguishes the unit more than small size is a built-in camera and a capture button, which work with preinstalled software to turn this computer into a digital camera for stills and full-motion video. And though the PictureBook suffers from some shortcomings because of its size, there's much to recommend it.

The unit's keyboard is a bit roomier than the LifeBook B112's keyboard. The screen is unusually wide, with 1,024-by-480 resolution (or roughly a 2-to-1 aspect ratio). The PictureBook's performance was on a par with others in the category, and battery life was 1:31. All told, the system is well worth considering,


The Toshiba Portégé 3020CT is the best mini-notebook overall.

especially if you can make use of the built-in camera. (Sony Electronics Inc., San Jose, CA; 408-432-1600; *www.sony.com*.)

Think of the **Toshiba Portégé 3020CT** ($1,900 street) as a money-saving alternative to the IBM ThinkPad 240. Weighing in at 2.8 pounds, the unit is physically similar to the ThinkPad 240 in size and weight and offers many of the same advantages, including a nearly full-size keyboard. The system is built around a lesser CPU (a 300-MHz Mobile Pentium MMX), however, and offers less performance (but better battery life) at an appropriately lower price.

The Portégé 3020CT's 18-mm key pitch is nearly a match for the ThinkPad 240's. Even better, unlike IBM's offering, the Portégé 3020CT leaves the control key in its standard position, immediately below the Left Shift key.

Performance was acceptable for this class, and its battery life of just over 3 hours on our test was very good. Note that Toshiba promises a 24-hour parts turnaround if something goes wrong, compared with IBM's two to three business day turnaround. If all you're doing on the road is word processing and relatively small spreadsheets, the Portégé 3020CT delivers plenty of computer and a comfortably large keyboard in a mini-notebook a touch typist can love. (Toshiba America Information Systems Inc., Irvine, CA; 800-959-4100; *www.toshiba.com*.)

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17.0 GB UltraDMA Hard Drive[1]	17.0 GB UltraDMA Hard Drive[1]	17.0 GB UltraDMA Hard Drive[1]	17.0 GB UltraDMA Hard Drive[1]
6X DVD-ROM Drive[2]	6X DVD-ROM Drive[2]	6X DVD-ROM Drive[2]	6X DVD-ROM Drive[2]
Savage4 Pro 16 MB 2X AGP Graphics Card	Savage4 Pro 16 MB 2X AGP Graphics Card	Savage4 Pro 16 MB 2X AGP Graphics Card	Savage4 Pro 16 MB 2X AGP Graphics Card
Diamond Monster Sound MX300 PCI Audio Card	Diamond Monster Sound MX300 PCI Audio Card	ESS Solo PCI Audio	Diamond Monster Sound MX300 PCI Audio Card
56K ITU V.90 Modem[5]	56K ITU V.90 Modem[5]	56K ITU V.90 Modem[5]	56K ITU V.90 Modem[5]
Klipsch v 2-400 Speakers	JBL Pro Premium Speakers w/Subwoofer	JBL Pro Premium Speakers w/Subwoofer	Klipsch v.2-400 Speakers
Digital Creativity Imaging Center[4]	Digital Creativity Imaging Center[4]	Digital Creativity Imaging Center[4]	Digital Creativity Imaging Center[4]
Home Phoneline Networking PCI Card[7]	100 MB Iomega Zip Built-In™ Drive with 2 disks[12]	Microsoft Office 2000 Small Business	Microsoft Featured Home Collection + MS Word
Microsoft Featured Home Collection + MS® Word	Microsoft Office 2000 Small Business	Microsoft Windows98	Microsoft Windows98
Microsoft Windows98	Microsoft Windows98	Compaq CV715 17" Monitor (16.0" VIA)	Compaq CV715 17" Monitor (16.0" VIA)
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15.0" TFT Active Matrix Display	15.0" TFT Active Matrix Display	13.3" TFT Active Matrix Display	13.3" TFT Active Matrix Display
64 MB SyncDRAM expandable to 128 MB	64 MB SyncDRAM expandable to 128 MB	128 MB SyncDRAM expandable to 192 MB	64 MB SyncDRAM expandable to 192 MB
4.8 GB UltraDMA Hard Drive	4.8 GB UltraDMA Hard Drive[1]	6.4 GB UltraDMA Hard Drive[1]	6.4 GB UltraDMA Hard Drive[1]
24X Max CD-ROM Drive[10]	24X Max CD-ROM Drive[10]	4X DVD-ROM Drive[9]	4X DVD-ROM Drive[9]
ATI Rage LT Pro Hardware Accelerated 3D Graphics w/8 MB Video Memory	ATI Rage LT Pro Hardware Accelerated 3D Graphics w/8 MB Video Memory	256-bit AGP Accelerated Graphics w/2.5 MB VRAM	256-bit Accelerated Graphics w/2.5 MB VRAM
56K ITU V.90 Modem[5]	56K ITU V.90 Modem[5]	56K ITU V.90 Modem[5]	56K ITU V.90 Modem[5]
Smart Lilon Battery	Smart Lilon Battery	Smart Lilon Battery	256 KB Integrated "On-chip" cache
256 KB Integrated "On-chip" cache	128 KB Integrated "On-chip" cache	256 KB Integrated "On-chip" cache	Microsoft Featured Home Collection
Microsoft Featured Home Collection	Microsoft Featured Home Collection	Microsoft Office 2000 Small Business	Microsoft Windows98
Microsoft Windows98	Microsoft Windows98	Microsoft Windows98	
$2599‡ As low as **$73 per month[3]**	**$2399‡** As low as **$67 per month[3]**	**$2999‡** As low as **$84 per month[3]**	**$2599‡** As low as **$73 per month[3]**
128 SyncDRAM: Add $200	128 SyncDRAM: Add $200	Port Replicator: Add $129	128 MB SyncDRAM: Add $200
6.4 GB UltraDMA Hard Drive[1]: Add $100	6.4 GB UltraDMA Hard Drive[1]: Add $100	Extra Smart Lilon Battery: Add $129	Extra AC Adapter: Add $49
4X DVD-ROM Drive[9]: Add $200	Stylish Case: Add $119	Extra AC Adapter: Add $49	External Iomega® Zip® Drive[12]: Add $149

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Back

1. Follow instructions on the other side

Inverted Back

1. Follow instructions on the other side

Folded edge of the page

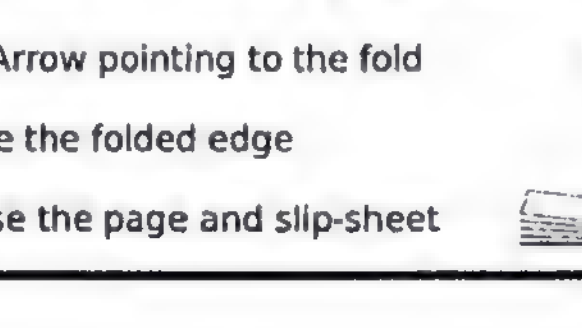
Inverted Foldout slip-sheet

GbsSlipSheet-001

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



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Base price includes:

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- Diamond Monster Sound MX300 PCI Audio Card
- 6.0Mb Max Digital Modem[4]
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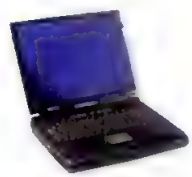

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PRESARIO 1900T INTERNET NOTEBOOK PC

PRESARIO 1800T-PII 400 INTERNET NOTEBOOK PC

Base price includes:

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- 6.4 GB UltraDMA Hard Drive[1]
- 4X DVD-ROM Drive[2]
- ATI Rage LT Pro Hardware Accelerated 3D Graphics w/8 MB Video Memory
- 56K ITU V.90 Modem[3]
- Smart Lilon Battery
- 256 KB Integrated "On-chip" cache
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IJ900 Printer (shown)	$199
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INTERNET PC

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- 32X Max CD-ROM Drive[1]
- Savage4 Pro 16 MB 2X AGP Graphics Card
- ESS Solo PCI Audio
- 56K ITU V.90 Modem[2]
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INTERNET NOTEBOOK PC

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- 256-bit AGP Accelerated Graphics w/2.5 MB VRAM
- 56K ITU V.90 Modem[2]
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- 128 KB Integrated "On-chip" cache
- Microsoft Featured Home Collection
- Microsoft Windows®98

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Thin & Light NOTEBOOKS

By Bruce Brown

For on-the-go connectivity without the bulk and weight of a traditional laptop PC, choose a thin and light notebook (sometimes referred to as a subnotebook). Targeted specifically at traveling executives (and others who can afford often substantial price premiums to gain mobility), a thin and light model is ideal for those who find themselves running through airports a couple of times a month.

The notebooks in this class typically weigh between 5 and 6 pounds with battery and are just 1 to 1.5 inches deep. But don't let the svelte case fool you: These premium machines typically have high-power CPUs and generous hard disks. You won't give up connectivity while on the run with one of these lightweights, given their abundance of ports, internal modems (usually), and internal Ethernet connectors (in some cases). Do note that, as with the mini-notebooks, the only built-in drive is the hard disk; floppy disk, CD-ROM, and DVD drives are external.

The Compaq Presario 1925 came loaded for bear.

Weighing in at a moderate 4.4 pounds with battery, the **Alcam Executive 700** ($1,899 direct) is based on a Pentium II/300 and has a 12.1-inch TFT display (800-by-600 resolution). The Executive's attractive price includes an external floppy disk drive, a PC Card modem, and a port replicator. If low price is a priority, then the Executive is worth a look, but note that others surpass it in performance and support.

At just shy of 2 hours, its battery life trailed the pack (2.5 to 3 hours for most others). With just a one-year warranty and without on-site service, 24-hour 7-day technical support, or a fast replacement service, Alcam is also behind the curve on support. (Alcam Corp., Fremont, CA; 510-490-2502; *www.alcam.com*.)

The 5-pound **Compaq Presario 1925** ($3,300 street) came loaded for bear, with 128MB of SDRAM and a 9.5GB IBM hard disk. Based on a Mobile Pentium II/400 processor, the Presario 1925 was the performance champ in this category, thanks in large part to that extra RAM (others in this class came equipped with 64MB). The Presario line is targeted for home and home office use, and the Presario 1925 is good for road warriors as well (as long as you can do without the next-day parts replacement service avail-

BLUETOOTH: SOON YOUR DEVICES WILL TALK TO EACH OTHER

In the age of the Internet, you can easily forget that computers are still relatively dumb devices when it comes to networking. Without human intervention, a PC has no ability to "see" other PCs, peripherals, PDAs, or cell phones around it. But a new technology, with the curious code name of Bluetooth, is aiming to change all that.

Bluetooth is a set of technologies (hardware, software, and open standards) that will allow devices within close range to recognize and connect automatically to one another wirelessly using radio frequency. Bluetooth can handle both data and voice communications, and its throughput of 720 Kbps makes it sufficient for a wide range of applications—though it can't match the speed of infrared. But unlike infrared, Bluetooth doesn't require devices to be within direct line of sight. Importantly, Bluetooth operates on the unlicensed 2.4-GHz frequency, which means that currently the technology can be used freely throughout the world—increasing its odds of becoming a widely deployed, international standard.

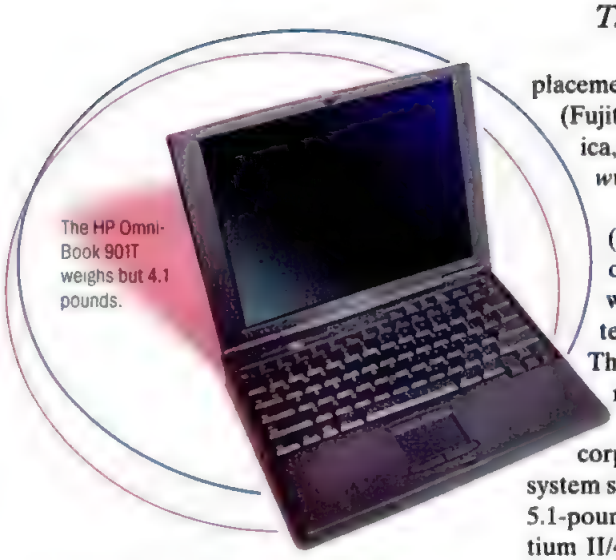
There are many applications for Bluetooth technology, but they can be divided into three general categories. First, it can be used for voice and data access points for accessing e-mail or browsing the Web wirelessly. For example, your airport gate would have an access point, and your PC would automatically detect it and establish a connection, letting you work while waiting for your flight to board.

Second, Bluetooth can help eliminate that tangle of cables behind your desktop PC. Your PC would simply attach itself to a nearby Bluetooth-enabled device, such as a cell phone, PDA, keyboard, printer, or joystick.

Perhaps the most promising use of Bluetooth will be as an ad hoc networking technology. Because all Bluetooth-enabled devices can automatically establish connections to one another, you will be able to create mini-networks, called *piconets*, as you move around the office. These piconets can be point-to-point connections (a cell phone synchronizing data with a PC, for example), or they can be multipoint-to-point connections with up to eight devices networked simultaneously. Bluetooth has a range of 10 meters (expandable to 100 meters with amplifiers).

Much has been made of the fact that Bluetooth uses the same frequency as microwave ovens and therefore could run into interference problems. But the way Bluetooth is implemented—by using shorter packet sizes and hopping between frequencies faster than other systems—should minimize these problems, according to the Bluetooth Special Interest Group, a consortium of more than 700 companies established last year by Ericsson, IBM, Intel, Nokia, Toshiba, and others.

There are several ways in which Bluetooth can be implemented. Smaller devices such as cell phones and PDAs will have embedded Bluetooth chips. You'll also be able to add Bluetooth connectivity to existing notebook PCs with a PC Card or via the USB port. Expect to see these smarter devices arriving on shelves in early 2000.—*John Morris*


The HP OmniBook 901T weighs but 4.1 pounds.

able on other Compaq models).

Dedicated keyboard keys for Internet access and e-commerce are convenient features. Unlike most other notebooks, the Presario 1925 comes standard with a 2X DVD-ROM drive in a removable drive wedge (1.9 pounds) that fits beneath the unit. The wedge supports hot-swapping other components via a software switch. An internal 56K modem and a 13.1-inch XGA TFT display complete the package.

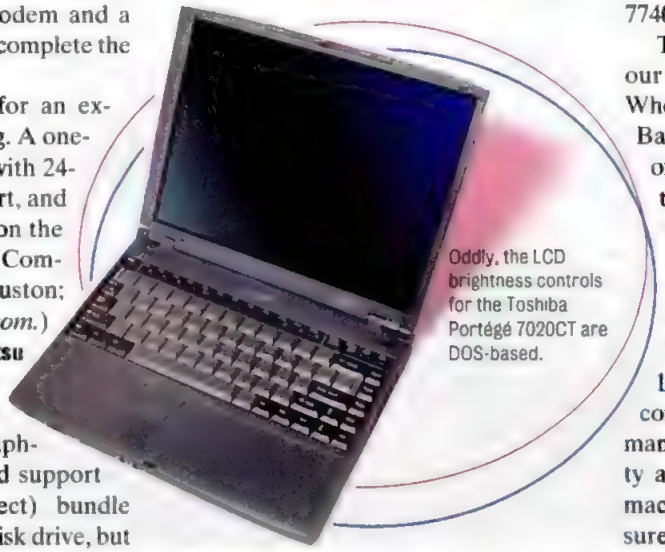
The Presario 1925 ran for an excellent 3:44 in battery testing. A one-year warranty is standard, with 24-hour, 7-day technical support, and the model-specific support on the Internet is comprehensive. (Compaq Computer Corp., Houston; 800-888-0220; *www.compaq.com.*)

The 4.3-pound **Fujitsu LifeBook L470** is a fine choice for road warriors. It is easy to reconfigure with added peripherals and is backed by good support policies. The $3,099 (direct) bundle includes an external floppy disk drive, but you'll have to add a CD-ROM ($100) or DVD-ROM ($500) drive plus the detachable storage bay ($125) to make it as full-featured as others in its price range.

The LifeBook L470's 2:18 tested battery life was at the low end for tested notebooks, but other performance scores fell well within the expected ranges for a Mobile Pentium II/366 model. Service and support policies are above average, including a three-year parts-and-labor warranty with 24-hour, 7-day toll-free tech support and a $49.95 per year charge for on-site service, although 24-hour replacement turnaround isn't available. (Fujitsu Computer Products of America, San Jose, CA; 408-432-6333; *www.fujitsu.com.*)

The **Gateway Solo 3150 LS** ($2,924 direct) is a good value, delivering fine performance, a wealth of features, and long battery life at a competitive price. The Solo 3150 LS's one-year warranty and no 24-hour replacement policy are limitations for a corporate fleet, but that aside, the system should be on your short list. The 5.1-pound unit contains a Mobile Pentium II/400 processor; with its internal 56K modem, 3Com 10/100 NIC with RJ-45 jack, and 24X DVD-ROM drive, it comes ready for connectivity and entertainment.

The Solo 3150 LS's 12.1-inch screen (800-by-600 resolution) is bright and clear. A hardware volume-control dial adds a quick way to adjust the audio to user preferences. The Solo 3150LS performed well compared with other systems with the same CPU and memory configuration, and its 3:13 tested battery life was better than most others as well. Gateway's documentation, both on-disk and on the Internet, are a cut above that of most other vendors. Web-based support even includes full documentation, bug fixes, and BIOS upgrades. (Gateway, North Sioux City, South Dakota; 800-428-3929; *www.gateway.com.*)


Oddly, the LCD brightness controls for the Toshiba Portégé 7020CT are DOS-based.

The 4.1-pound **HP OmniBook 901T** fits nicely into a corporate notebook fleet, since it shares docking stations and drives with other OmniBook models. The unit's $3,000 street price includes a floppy disk drive plus a module bay for other devices. Available 24-hour parts replacement and warranty extensions for service worldwide make the OmniBook 901T a fine choice.

Easy hot-swapable drive switching and simultaneously active pointing stick and touch pad cursor control devices underscore the OmniBook 901T's usability. Three docking options are available; these consist of a port replicator, a mini-dock, and a full docking station. The OmniBook 901T does not come with an internal Ethernet port, but the DMI 2.0–compliant notebook does have HP TopTools 2.1 installed for network management with an added PC Card or docking station NIC.

The OmniBook 901T's performance scores were average for a Mobile Pentium II/366 machine. Battery life, however, tested at a rather low 2:16. (Hewlett-Packard Co., Santa Clara, CA; 800-637-7740-; *www.hp.com.*)

The **IBM ThinkPad 570** ($3,100 street) is our Editors' Choice in this category. When you pair it with its modular UltraBase ($400 street), you get the best of both worlds: a 4-pound, 1-inch-thick thin and light notebook that can be quickly converted to a 7-pound all-in-one system. Based on a Mobile Pentium II/333, the ThinkPad 570 comes with an integrated 56K modem and a 13.3-inch TFT display capable of 1,024-by-768 resolution. Add class-competitive benchmark test performance and a three-year standard warranty and the ThinkPad 570 becomes the machine against which others are measured. Do note that if you usually take along a CD-ROM or DVD drive, then IBM's 5.6-pound ThinkPad 600E—an Editors' Choice in the desktop replacement category—is probably the right choice, since you can carry just the extra drive and not the entire base.

The UltraBase fits neatly underneath the ThinkPad 570. One side can hold the floppy disk drive or a second battery, and the other side can hold a variety of hot-swappable optional drives. On-disk documentation includes a searchable system manual and software for easily and graphically configuring the system and its

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BENCHMARK TESTS

Notebooks

PC MAGAZINE LABS

Different classes of notebooks will net different performance results. In general, the desktop replacements perform the best, followed by (in descending order) the mainstream, thin and light, value, and mini-notebooks.

What the Numbers Mean

The ZD Business Winstone 99 tests show differences in overall system performance. Since vendors were free to send the most powerful desktop replacement systems in their arsenal, they loaded them with fast CPUs and 128MB of RAM each. It's no surprise that the best-performing processor won: Systems with Pentium II/400s outscored those with Pentium II/366s by just over 9 percent. We ran all tests at the standard resolution delivered by the LCD screen, which gave a slight advantage to those notebooks with lower resolutions.

We allowed mainstream, value, and mini-notebook vendors to send any configuration that fell within our price range; as a result, the memory amounts varied. Since Winstone runs its applications using task switching, it is more memory-sensitive than previous versions of the test; thus, units with more memory, in theory, would have scored higher. This did in fact play out: The Dell Latitude CPt C400GT (a mainstream notebook) came with 128MB of memory (versus the 64MB that came with most of the others), which gave it a small performance boost on Winstone. Likewise, the IBM ThinkPad 390E came with only 32MB, and it got the lowest Winstone score among the mainstream notebooks.

In the value category, the NEC Versa Note and the Chembook 7200 used a slightly less powerful processor for this class—a Celeron 300—but paired it with 64MB of memory to get the best balance of memory and processor performance. Conversely, the AMS Roadster 21CT366, IBM ThinkPad iSeries 1412, and Sony VAIO PCG-F150 came with the most powerful processors in the category but only 32MB of RAM—which hurt their scores.

The thin and light notebooks generally came with 64MB of RAM and Pentium II processors. The Compaq Presario 1925, based on a Pentium II/400 and equipped with 128MB of RAM, took top honors, and the HP OmniBook 901T with a Pentium II/366 beat out two other Pentium II/400–based machines for second place.

The mini-notebooks are very small and (except for the IBM ThinkPad 240) underpowered compared with full-size models. The mini-notebooks from Fujitsu, Sony, and Toshiba all came with Pentium MMX CPUs, and the top-performing IBM came with a Celeron.

Our new ZD BatteryMark 3.0 gives a good measure of useful battery life. The two Gateway 2500 notebooks, one with a Celeron and one with a Pentium II processor, scored 5:05 and 5:31, respectively—the best results in the roundup. Thin and light and mini-notebooks should be a road warrior's dream (read: they should have great battery life), but some of them fell short of the mark. The IBM ThinkPad 570 and Sony VAIO PCG-Z505SX (thin and light) and the IBM ThinkPad 240 and Sony VAIO C1 PictureBook (mini-notebook) each lasted less than 2 hours on the BatteryMark test.

Our ZD CPUMark 99 test shows the differences among processor cores, their caches, and speeds. On the average, the Pentium II's took top honors when compared clock for clock among the CPUs. The WinBook XL[2] (with an AMD K6-2 processor) and the ACT Brillianta NH-7156 (with a Celeron/400) both exhibited anomalies that gave them very low scores. We suspect the power management settings are taking effect even though we turned them off for test-

High scores are best.
Bold type denotes first place.
PC denotes Editors' Choice.

	Processor type	Tested RAM	ZD Business Winstone 99	ZD BatteryMark 3.0	ZD CPUmark 99	ZD Business Graphics WinMark 99	ZD Business Disk WinMark 99 (thousands of bytes/sec)	ZD CD-ROM WinMark 99: Overall (thousands of bytes/sec)
MINI-NOTEBOOK								
Fujitsu LifeBook B112	PMMX/233	32MB	9.1	**4:18**	13.1	50	1,160	N/A[1]
IBM ThinkPad 240	Mobile C/300	64MB	15.0	1:02	24.1	57	1,960	N/A[1]
Sony VAIO C1 PictureBook	PMMX/266	64MB	11.3	1:31	12.8	N/A[2]	N/A[2]	N/A[1]
PC Toshiba Portégé 3020CT	PMMX/300	32MB	8.1	3:00	12.3	36	1,380	N/A[1]
THIN AND LIGHT								
Alcom Executive 700	PII/300	64MB	14.4	1:59	23.1	104	1,240	982
Compaq Presario 1925	Mobile PII/400	64MB	**18.0**	3:44	**34.5**	**120**	1,850	**1,230**
Fujitsu LifeBook L470	Mobile PII/366	64MB	15.2	2:18	32.2	51	1,960	821
Gateway Solo 3150 LS	Mobile PII/400	64MB	17.3	3:13	33.9	102	1,800	663
HP OmniBook 901T	Mobile PII/366	64MB	17.8	2:16	31.7	82	1,730	1,220
PC IBM ThinkPad 570	Mobile PII/333	64MB	16.6	1:46	29.0	106	1,830	692
NEC Versa SX	Mobile PII/400	64MB	17.3	2:04	34.1	63	**2,080**	836
Sony VAIO PCG-Z505SX	Mobile PII/366	64MB	16.4	1:31	30.8	81	1,820	829
Toshiba Portégé 7020CT	Mobile PII/366	64MB	16.3	1:59	32.7	74	1,920	1,080
			BETTER ▶	BETTER ▶				

N/A[1]— Not applicable. Mini-notebooks do not ship with CD-ROM drives
N/A[2]— Not applicable. This product could not perform the test

▲ On ZD Business Winstone 99, the mini-notebooks generally trailed machines in other categories. The exception was the new IBM Thinkpad 240, built around a 300-MHz Mobile Celeron CPU. One would think that mini-notebooks and thin and light notebooks would have amazing battery life. The reality: Many could barely pass the 2-hour mark on our BatteryMark 99 test. The Fujitsu LifeBook B112, a mini-notebook, shone at 4:18.

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BENCHMARK TESTS

High scores are best. Bold type denotes first place. PC denotes Editors' Choice.

	Processor type	Tested RAM	ZD Business Winstone 99	ZD BatteryMark 3.0 (hours:minutes)	ZD CPUmark 99	ZD Business Graphics WinMark 99	ZD Business Disk WinMark 99 (thousands of bytes/sec)	ZD CD-ROM WinMark 99: Overall (thousands of bytes/sec)
MAINSTREAM								
Acer TravelMate 721TX	Mobile PII/333	64MB	**18.3**	3:55	29.2	111	**1,990**	951
ACT Brillianta NI-7134	C/400	64MB	13.4	2:08	19.2	50	1,580	627
ARMNote TS3100	C/433	64MB	17.2	1:01	31.1	123	1,790	983
Compaq Prosignia 150	AMD K6-2 400	64MB	16.3	2:13	28.7	108	1,770	1,190
PC Dell Latitude CPt C400GT	Mobile C/400	128MB	17.9	3:33	30.9	**136**	1,900	**1,270**
FutureTech FutureMate FM31XL	C/433	64MB	16.4	1:50	32.0	122	1,630	1,010
Gateway Solo 2500 LS	Mobile PII/333	64MB	14.3	**5:31**	29.3	47	1,840	719
HP OmniBook XE2 333	Mobile PII/333	64MB	15.9	3:28	29.6	75	1,650	920
IBM ThinkPad 390E	Mobile PII/333	32MB	10.3	2:58	26.3	65	1,330	1,090
Micron TransPort TREK²	Mobile C/400	64MB	16.9	2:46	29.5	119	1,640	1,210
PC Notebook Cheetah IIc Pro	C/466	64MB	16.4	N/A	**33.2**	94	1,630	1,030
Toshiba Satellite 4030CDT	Mobile C/300	64MB	13.9	2:33	25.5	52	1,650	961
WinBook XL² C400	C/400	64MB	16.4	2:18	30.6	117	1,620	1,130

N/A–Not applicable. Because of a faulty battery, the machine could not complete this test.

BETTER ▶ BETTER ▶

▲ **Winstone** is very memory-sensitive. The notebooks in the mainstream category came with varying amounts of memory, which affected their Winstone score. The Dell Latitude CPt C400GT, with 128MB of RAM, posted the best score, while the IBM ThinkPad 390E, with only 32MB of RAM, came in last. Battery life in this class varied widely, from an impressive 5:31 for the Gateway machine to just 1:01 for ARM's entry.

ing. Another possibility is a driver that may be constantly requesting servicing from the CPU, thereby dragging down its score.

The ZD Business Graphics WinMark 99 score reflects the performance of the notebook's 2-D graphics subsystem. Since the suite tests 2-D performance, no floating-point processes are included. As a result, raw clock speed and integer performance can help make the best performer. The leaders were two systems using Pentium II/400s and one using a Celeron/400: The IBM ThinkPad 600E features a Pentium II/400 and the NeoMagic MagicMedia 256AV graphics chip; the Dell Inspiron 7000 A400LT also has a Pentium II/400 but uses an ATI Rage LT Pro graphics chip; and the Dell Latitude CPt 400GT uses a Celeron/400 and NeoMagic's new MagicMedia 256ZX.

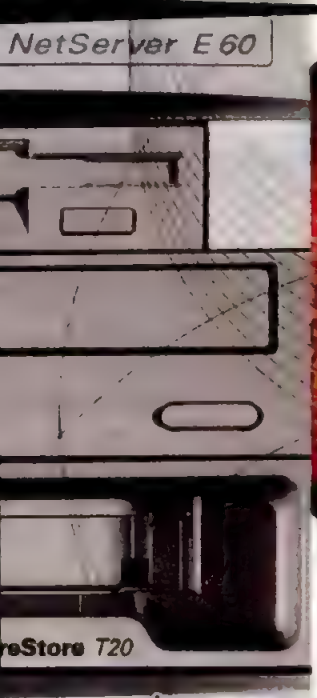
High scores are best. Bold type denotes first place. PC denotes Editors' Choice.

	Processor type	Tested RAM	ZD Business Winstone 99	ZD BatteryMark 3.0 (hours:minutes)	ZD CPUmark 99	ZD Business Graphics WinMark 99	ZD Business Disk WinMark 99 (thousands of bytes/sec)	ZD CD-ROM WinMark 99: Overall (thousands of bytes/sec)
DESKTOP REPLACEMENT								
Brick Ergo BigScreen⁶	Mobile PII/366	128MB	19.8	1:55	31.3	120	2,010	611
Compaq Armada 7800	Mobile PII/400	128MB	18.6	3:24	33.0	71	1,990	591
PC Dell Inspiron 7000 A400LT	Mobile PII/400	128MB	20.5	**3:51**	34.6	**136**	2,070	**1,200**
FOSA AP 2100P	Mobile PII/333	128MB	18.2	1:46	29.3	111	1,950	951
Gateway Solo 9150	Mobile PII/400	128MB	**21.1**	3:45	33.5	128	2,220	584
HP OmniBook 4150	Mobile PII/400	128MB	19.0	2:40	34.1	84	1,840	617
PC IBM ThinkPad 600	Mobile PII/400	128MB	20.6	3:24	34.2	**136**	2,010	811
MAG Verity 8536CDT	Mobile PII/366	128MB	17.9	3:20	32.5	91	2,010	1,070
Micro Express MP6366V	Mobile PII/366	128MB	18.7	3:20	31.1	116	1,730	823
Micron TransPort NX	Mobile PII/366	128MB	20.0	3:04	31.7	121	2,110	563
Midwest Micro Solis	Mobile PII/400	128MB	20.9	3:29	**34.7**	127	2,010	626
NEC Versa LX	Mobile PII/400	128MB	20.6	3:34	34.2	122	2,110	645
Panasonic Toughbook 71	Mobile PII/366	128MB	18.9	3:08	32.4	78	2,070	652
Quantex I-1410	Mobile PII/400	128MB	20.2	3:37	**34.7**	126	2,120	630
Sceptre SoundX 6500	Mobile PII/366	128MB	19.4	3:10	32.3	123	1,840	674
Sony VAIO PCG-F190	Mobile PII/366	128MB	16.9	1:58	31.9	68	1,450	1,040
Toshiba Tecra 8000	Mobile PII/366	128MB	17.0	3:17	32.9	64	1,600	1,090
WinBook XL² PII 400	Mobile PII/400	128MB	20.5	3:08	34.4	124	**2,320**	1,010

BETTER ▶ BETTER ▶

We attempted to run ZD 3D WinBench 99 on these notebooks but succeeded on only a handful of machines. Many notebooks did not have Direct3D HAL (Hardware Abstraction Layer) loaded. The 3D HAL is a device-dependent driver (supplied by the graphics chip vendor) that acts as an interface between the device-independent Direct3D APIs and the graphics hardware. Others had drivers that were not compatible with DirectX 6, and still others did not have enough graphics memory to run in their screens' native resolutions with 16-bit color and triple buffering. Such oversights and cost cutting are excusable for value-oriented machines, but we feel that at this stage of the game notebooks that include chips that can deliver 3-D should at least enable the

▲ **Disk WinMark 99** measures the performance of a PC's hard disk subsystem. Hard disks in notebooks still lag behind those in desktops: 7,200-rpm drives are common in desktops; 4,900-rpm drives are the max for notebooks. The WinBook XL² PII 400, with a 4,200-rpm Hitachi drive, posted the top Disk WinMark score. Overall performance, as measured by Winstone, was the best in this category, thanks to speedy processors and scads of ram.



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BENCHMARK TESTS

High scores are best.
Bold type denotes first place.
denotes Editors' Choice.

Processor type	Tested RAM	ZD Business Winstone 99	ZD BatteryMark 3.0 (hours: minutes)	ZD CPUmark 99	ZD Business Graphics WinMark 99	ZD Business Disk WinMark 99 (thousands of bytes/sec)	ZD CD-ROM WinMark 99: Overall (thousands of bytes/sec)
VALUE							
AMS Roadster 21CT366	C/366	32MB	10.4	3:10	19.0	55	1,220	**1,100**
Chembook 7200	C/300	64MB	**15.3**	4:41	25.0	83	**1,720**	1,000
Gateway Solo 2500 SE	Mobile C/333	32MB	10.9	**5:06**	25.3	56	1,310	713
HP OmniBook XE2 C333	Mobile C/333	32MB	10.3	3:11	26.9	85	1,230	978
IBM ThinkPad iSeries 1412	Mobile C/366	32MB	11.7	4:08	23.3	**116**	1,630	1,080
NEC Versa Note	Mobile C/300	64MB	15.1	2:26	24.6	58	1,640	965
Sony VAIO PCG-F150	Mobile PII/300	32MB	7.6	2:12	26.6	47	1,220	960
Toshiba Satellite 2535CDS	PMMX/300	64MB	8.4	4:10	12.5	54	1,170	947
WinBook XL	AMD K6-2 400	128MB	13.4	1:20	13.2	41	1,710	**1,100**

BETTER ▶ BETTER ▶

▲ **Winstone** performance for the value machines was acceptable but unimpressive, since cutting-edge processors and extra RAM add costs. The **WinBook XL**, despite an AMD K6-2, 256K L2 cache and 128MB of RAM, performed below our expectations. We checked the power-saving features the BIOS settings but were unable to rectify the problem and get the scores closer to what we expected.

capabilities for buyers. Six notebooks—the AMS Roadster 21CT366, Compaq Prosignia 150, Gateway Solo 9150, MAG Verity 8536CDT, Micron TransPort NX, and Micron TransPort TREK[2] were able to complete the 3D WinBench tests; each was equipped with an ATI Rage LT Pro graphics chip.

The ZD Business Disk WinMark 99 score centers on the notebook's disk subsystem. The WinBook XL[2] PII 400 with its Hitachi DK229A-10 drive scored the best in this roundup.

The ZD CD-ROM WinMark 99 suite tests the CD-ROM drive's performance. The top-performing CD-ROM drive was the Toshiba XM-1902B in the Dell Latitude CPt C400GT. It edged out its cousin, the Toshiba SD-C2202 DVD drive, which was in the Compaq Presario 1925.—*Analysis written by Rich Fisco*

How We Tested

We tested all notebooks with Microsoft Windows 98. Before testing, we prepared each system following a standard procedure to create a common state for the testing: We stripped each system's start-up configuration of all processes or tasks except for Systray, Explorer, and graphics card control panels; we set the display to the system's LCD resolution, 65,536 colors and small fonts; we disabled all power management features; we defragmented all hard disks before each test and let Windows 98 manage virtual memory settings; and we used the vendor's provided graphics driver for all tests. For our ZD BatteryMark 3.0 test, we used standard power management settings during testing: 2 minutes for hard disk time-out (or the closest value available) and Auto or Fast CPU speed. BatteryMark also uses Microsoft Advanced Power Management where possible to automate procedures and provide information.

We used our benchmark test program **ZD Winstone 99**, Version 1.0, to measure performance on 32-bit Windows applications. **ZD Business Winstone 99** measures the time a PC takes to execute a set of scripts that exercise eight office-suite Windows 98 applications and an Internet browser. The scripts include task switching between a suite application and the browser. Business Winstone 99 weights a PC's test timings based on the applications' unit market shares; it derives a composite number and converts that to a relative score. (The score is relative to the performance of a Dell Dimension Pentium MMX/233 with 32MB of RAM, at 1,024-by-768 resolution with 24-bit color, running Windows NT 4.0 with Service Pack 3. The reference score is defined as 10.0.)

ZD WinBench 99, Version 1.1, measures a system's graphics, disk, processor, and CD-ROM, performance under Windows 98.

The **ZD Business Graphics WinMark 99** score is based on a log of GDI operations used by the applications in the Business Winstone 99. The test score is normalized to reflect performance relative to the base system used for Winstone testing.

The **ZD Business Disk WinMark 99** score is based on logging disk functions used by the applications in the Business Winstone suite, reading each log file and playing back only the disk operations. We record the results in thousands of bytes per second, and we use the same weighting factors for each individual test result as we use in Business Winstone. Finally, we average the weighted results with a harmonic mean formula.

The **ZD CPUmark 99** score gauges the speed of a PC's processor subsystem, which includes the CPU, primary and secondary cache, and system RAM, under 32-bit operating systems. CPUmark 99 emulates the CPU activity of the real-world 32-bit applications used in Business Winstone 99. CPUmark 99 has a large memory footprint and its cache characteristics are representative of modern applications.

The **ZD CD-ROM WinMark 99**, Version 1.1, tests gauge the performance of each machine's CD-ROM subsystem, which includes the CD-ROM drive, adapter, and required software drivers. The tests are based on a profile of today's most popular Windows CD-ROMs.

In this issue we introduce our new **ZD BatteryMark 3.0**. Like BatteryMark 2.0, the new version measures a notebook's life by exercising three different 32-bit software workload engines, one each for processor, disk, and graphics tasks. BatteryMark 3.0 mixes these workloads together and adds periodic think times, or breaks, that reflect normal user pauses in work. BatteryMark 3.0 has changed how the work is done from a set time for each workload in Version 2.0 to a set amount of work in Version 3.0. One of the biggest shifts in BatteryMark 3.0 has to do with power management and how BatteryMark 3.0 works with it. While Version 2.0 operated with the Windows power management standard of its day—Advanced Power Management (APM)—Version 3.0 extends its power management repertoire to include the newer Advanced Configuration and Power Interface (ACPI). BatteryMark 3.0 can recognize and work with both ACPI and APM as long as the operating system—Windows 9*x* or even Windows 2000—supports them. We use standard power management settings during testing: 2 minutes for hard disk time-out (or the closest value available) and Auto or Fast CPU speed.

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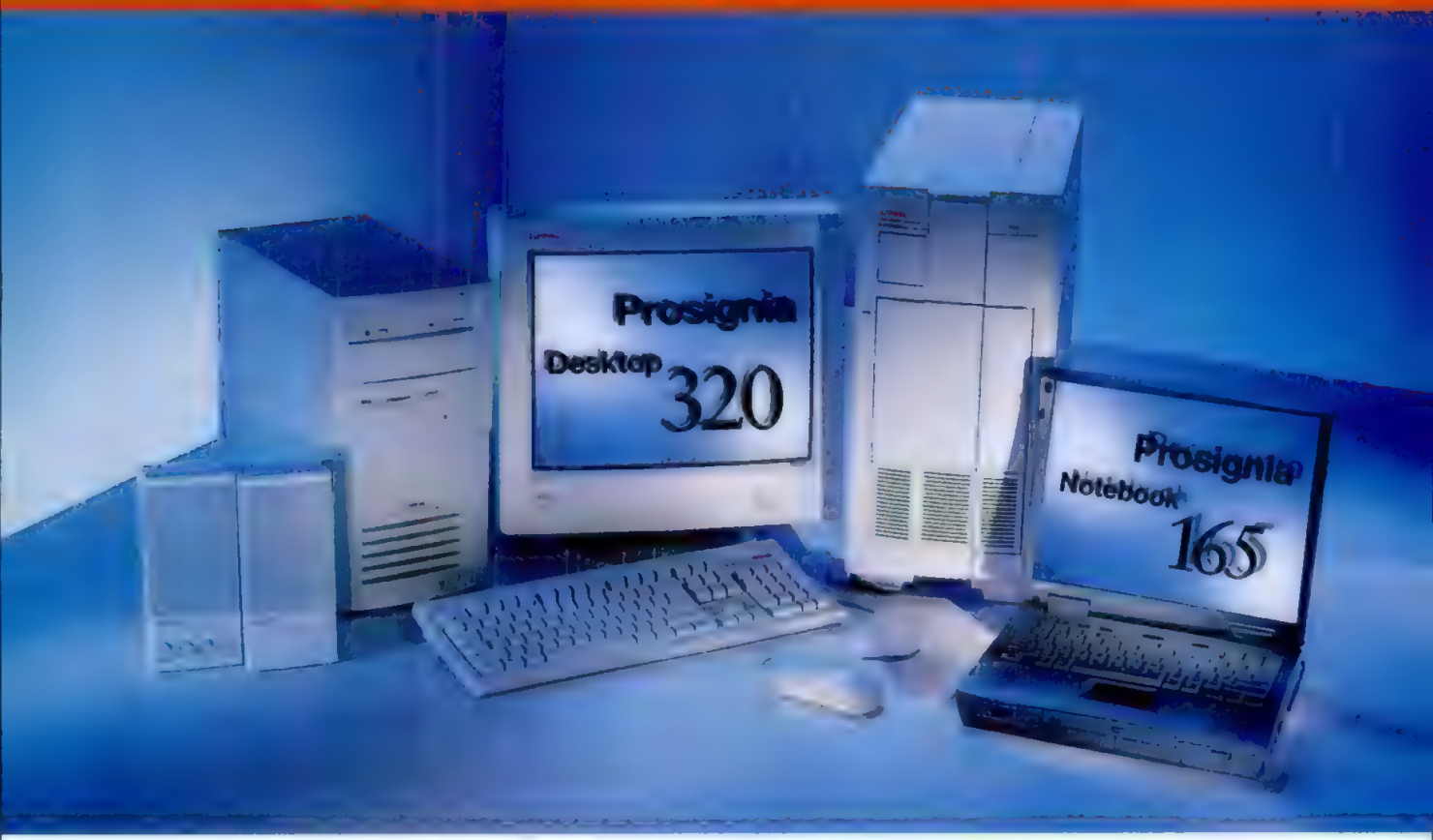

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There's a lot for corporate buyers to like about the Mobile Pentium II/400–based **NEC Versa SX** ($4,000 street), from its three-year standard warranty (with first year on-site service and 24-hour parts replacement) to the components and accessories it shares with other models in the Versa family.

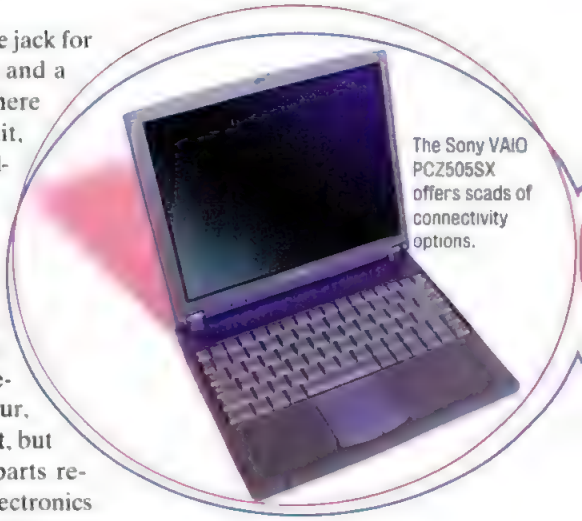
The Versa SX's 14.1-inch XGA-resolution TFT display is the largest in this category, which accounts for the system's weight of 5.3 pounds and relatively low (2:04) battery life. Although the Versa SX can accommodate a wide variety of devices in the modular Versa Bay, it doesn't support warm or hot swapping; you must turn the system power off to make a switch. NEC's extensive support, online as well as paper and on-disk documentation, augments the VersaSX's generous warranty. (NEC Computer Systems Division, Boxborough, MA; 888-863-2669; *www.nec-computers.com.*)

When *thin* and *light* are the most important attributes you seek in a notebook, the **Sony VAIO PCG-Z505SX** ($3,000 street) has to be near the top of your list. The 3.5-pound purple-and-gray beauty is just 1 inch thick, making it the slightest full-powered notebook in this class. A wide variety of connection options add to this unit's flexibility, though its tested battery life score was disappointing and its keyboard is slightly smaller than standard size.

The 12.1-inch TFT display is fine, and connections abound on the unit: two USB ports (one is a mini-port with an included dongle), an IEEE 1394 (FireWire) port (which Sony refers to as iLink) for capturing video from a digital video camera, an Ethernet LAN connector (with a dongle for an RJ-45 jack), PC Card slots, a phone-line jack for the internal 56K V.90 modem, and a slot for a Sony Memory Stick. There is no parallel port on the unit, though there is one on the included port replicator.

Powered by a Mobile Pentium II/366, the machine yielded average benchmark test scores. But it ran for only 1:31 on our battery test, the lowest life in this category. Sony's one-year warranty includes 24-hour, 7-day toll-free technical support, but no on-site service or 24-hour parts replacement is available. (Sony Electronics Inc., San Jose, CA; 408-432-1600; *www.sony.com.*)

The **Toshiba Portégé 7020CT** ($3,400 street) is a fine multipurpose portable with admirable features, but a few usability quirks detract from the package. Weighing in at just 4.1 pounds with a 13.3-inch TFT display (1,280-by-1,024 resolution) and an internal 56K modem, this Mobile Pentium II/366–based machine has the hardware right. Although the screen and keyboard are comfortable to use, to adjust the LCD's brightness, Windows 98 users have to run the DOS-based TSETUP utility to access the power management settings in order to select one of three brightness levels (Windows NT users can run the same utility from within Windows). Also, while paper documentation is comprehensive and well written, there is no system documentation on the hard disk, and the technical support information on the Internet is uneven, containing drivers and BIOS updates but no troubleshooting FAQs or information.



The Sony VAIO PCZ505SX offers scads of connectivity options.

In its favor, the optional DVD Network Dock ($650 street)—which includes a DVD-ROM drive, an Ethernet port, and speakers—makes the Portégé 7020CT a versatile system for use on the road or in the office. Benchmark test performance numbers were average for the category, although the battery test score of 1:59 was disappointing. For $79, you can augment Toshiba's three-year-parts, one-year-labor warranty to include first-year on-site service with available 24-hour parts replacement. (Toshiba America Information Systems Inc., Irvine, CA; 800-959-4100; *www.toshiba.com.*)

Mainstream NOTEBOOKS

By Angela Graven and Cade Metz

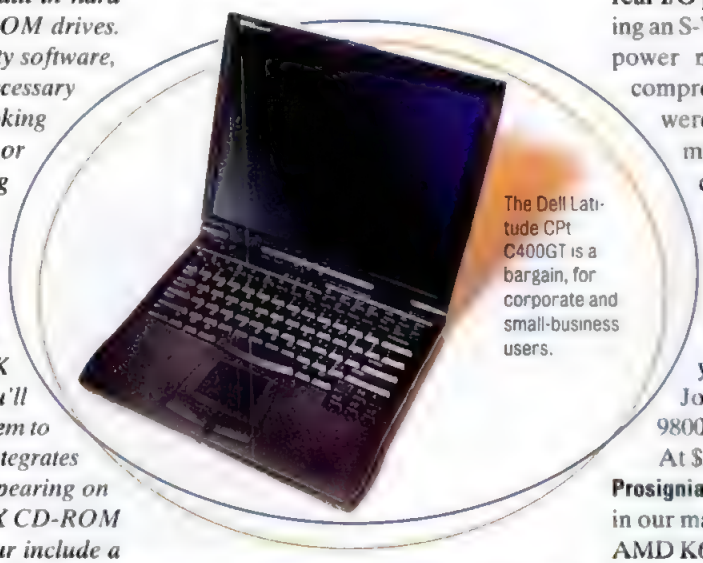
If you're looking for the right mix of functionality, affordability, portability, and performance—in that order—then a mainstream machine is probably right for you. Built with the business user in mind, most of the notebooks in this category come with the necessities for working on the road or at home, offering built-in hard disk, floppy disk, and CD-ROM drives. Some also bundle productivity software, and most possess all the necessary ports and components for hooking up to a monitor, projector, or standard television for making presentations.

What you might not find are the cutting-edge extras that add cost. For example, only 5 of the 13 models we tested deliver an integrated 56K modem (with the others, you'll need a separate PC Card modem to connect), and only the Acer integrates Ethernet capabilities now appearing on high-end machines. Also, 24X CD-ROM drives are the norm; only four include a DVD-ROM drive (it's a $150 to $450 option on most others). Also, only a few systems have bays with easily swappable components; to save cost, most have fixed drives or screwed-in components.

The Pentium II/333–based **Acer TravelMate 721TX** is well equipped for a sub-$2,300 portable. Acer provides an integrated floppy disk drive in the 7.9-pound system and lets you replace the system's 20X CD-ROM drive with a DVD drive, a second hard disk, or a SuperDisk drive.

From the outside, the TravelMate resembles the classic all-in-one notebook. Its dark gray chassis integrates an average touch pad, a fairly adept keyboard, and a 14-inch active TFT. Acer has gone beyond the basics, with an internal 56K modem, an Ethernet adapter, an external volume control knob, and an S-Video port (handy if you opt to use Acer's DVD drive). Though Acer loads its own Notebook Manager interface—which lets you adjust a few power management features, set passwords, and control the system's boot sequence—there is little other machine-specific help. The TravelMate's Winstone and BatteryMark (3:55) scores were above average. (Acer America Corp., San Jose, CA; 800-733-2237, 408-432-6200; *www.acer.com/aac.*)

Equipped with a competent array of hardware, All Computer Technology's **ACT Brillianta NI-7134** ($1,828 direct) is an acceptable machine for the price. Its reasonable 7.0-pound weight includes integrated floppy disk and DVD drives, and its few flaws can be forgiven for the price. The Brillianta's hardware is average, including its keyboard, 13.2-inch TFT display, and touch pad pointing device. The mouse buttons aren't as comfortable to use as most, but the chassis offers a full palm rest and a full complement of I/O ports.



The Dell Latitude CPt C400GT is a bargain, for corporate and small-business users.

The unit's benchmark test performance was below average relative to other machines in this category. Battery life (2:08) was also low, and the one-year warranty is standard fare for the price. (All Computer Technology, City of Industry, CA; 800-775-1953, 626-369-4181; *www.allcomp.com.*)

ARM Computer's **ARMNote TS3100** ($1,999 direct) is an adequate and affordable machine. The 7.4-pound model we received for testing included a 13-inch TFT display and a nickel hydride battery, but ARM reports that a 14-inch screen and a lithium ion battery will soon be available in an otherwise identical machine at the same $1,999 price tag. The battery upgrade is welcome, as the unit lasted only 1:01 on our tests.

The silver-colored ARMNote chassis is attractive and reasonably well designed. The floppy disk and CD-ROM drives easily slide in and out of this chassis, as does the primary battery. There isn't a door for protecting the machine's rear I/O ports, but plenty of I/O—including an S-Video jack—is available. ARM's power management paradigm is less comprehensive. During testing, we were unable to suspend the machine—neither to RAM nor to disk. ARM ships this modest machine with Corel WordPerfect Office and provides—remarkably—a lifetime labor warranty. Parts replacement, however, is provided for only a year. (ARM Computer Inc., San Jose, CA; 800-765-1767, 408-935-9800; *www.armcomputer.com.*)

At $2,350 street, the 7-pound **Compaq Prosignia 150** is the highest-priced system in our mainstream category. Offering an AMD K6-2/400 CPU, a 10GB hard disk, a DVD drive, a 14.1-inch TFT screen, and Microsoft Office 2000 Small Business Edition, its wealth of features and services would compliment any small to medium-size business and make it worth the price.

Unlike some of the other systems, the Prosignia lacks an S-Video port, IR port, and the ability to easily swap out the hard disk. But the Prosignia makes up for these faults with sharp DVD playback, wonderful stereo sound, and four Easy Access Buttons. Located just under the touch pad, these buttons give quick access to the Internet, Calendar, and Calculator. A fourth button can be assigned to your favorite application with the Easy Access Button software. The Prosignia yielded a somewhat low 2:13 on our battery test and was an average performer otherwise.

All Prosignias come with a Compaq Easy Internet Access wizard and 50 hours of free access. Compaq backs the Prosignias with a one-year parts-and-labor warranty, which includes 24-hour, 7-day toll-free technical support and one year of

free second-business-day pickup and delivery of systems needing repairs. Compaq's Web site also offers comprehensive support, such as driver updates, BIOS upgrades, and documentation. Perfect for the small and medium-size business, Compaq's Online Services offers e-commerce solutions, remote backup, and secure, compressed electronic data delivery. (Compaq Computer Corp., Houston; 800-345-1518, 281-370-0670; *www.compaq.com.*)

The Gateway Solo 2500 LS ran for an amazing 5:31 on a single charge.

At $2,097 direct, the **Dell Latitude CPt C400GT** is a bargain, delivering the right mix of performance and features for road or office. The package includes a 400-MHz Intel Celeron CPU, a 14.1-inch screen, and Dell's excellent OpenManage software, so an IS department can easily manage, support and track the machine. At 6.5 pounds, the unit is also one of the lightest notebooks in this category.

The Latitude has a very comfortable keyboard with an ample palm rest and a well positioned touch pad. Two modular bays offers many options, such as the ability to run the system with two batteries or to swap one of the drives for a SuperDisk ($199) or DVD drive ($299). The hard disk (held in place by one screw) is also removable. The unit's full contingent of ports can be augmented with a port replicator ($399) or docking station ($699).

Along with its flexible features and impressive benchmark test scores, Dell includes a one-year parts-and-labor warranty with next-business-day on-site service. The Dell Web site is extremely helpful, with system documentation, a library with downloads, diagnostics, and Ask Dudley!, a query system based on Dell's online Knowledge Base and Support Site. (Dell Computer Corp., Austin, TX; 800-388-8542, 512-338-4400; *www.dell.com.*)

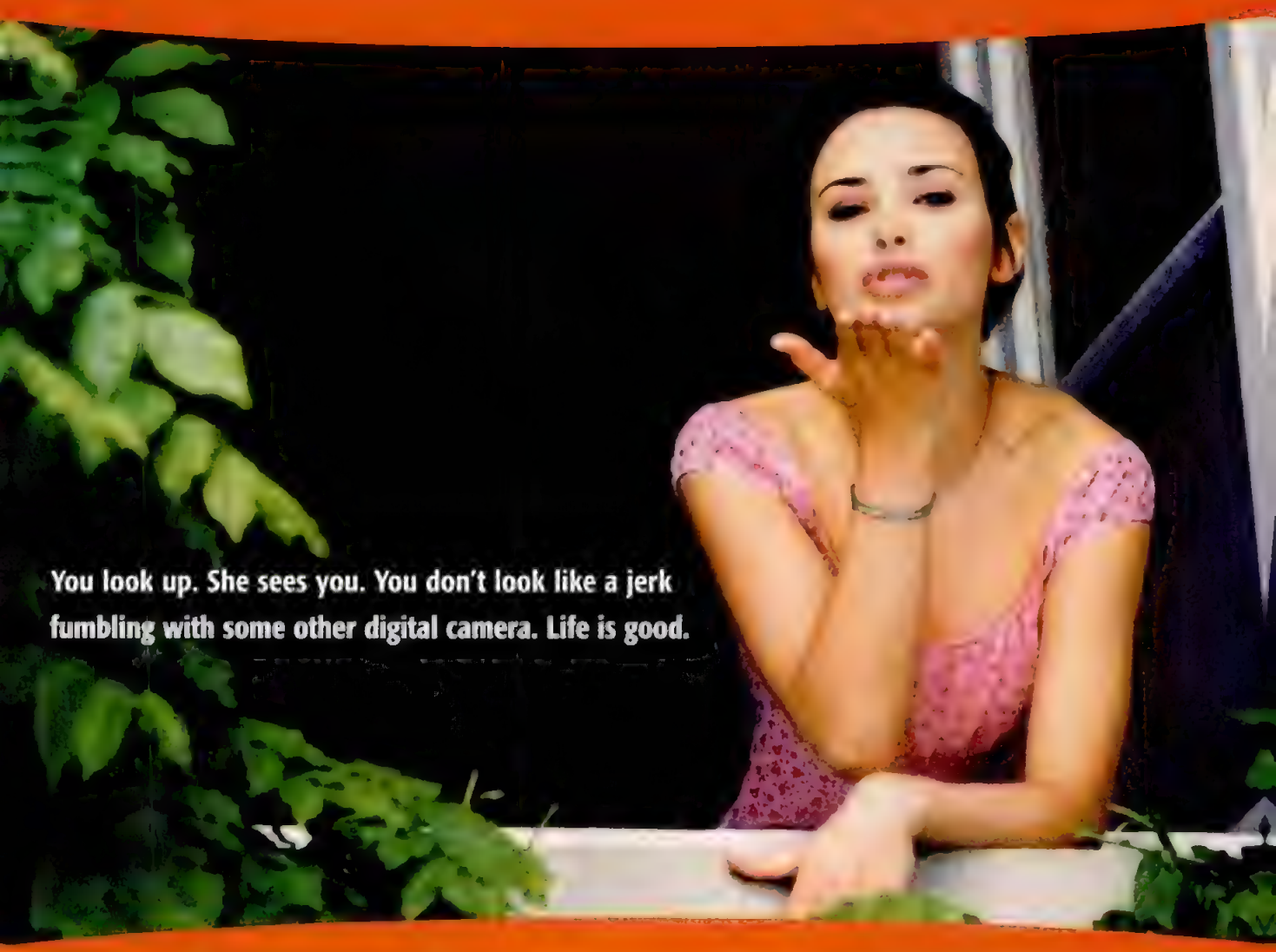
Sold directly as well as via resellers, the $2,029 **FutureTech FutureMate FM31XL** offers three spindles and a 14.1-inch TFT screen in a manageable 7.2-pound package. The FutureMate chassis is quite modular, letting you easily swap its floppy disk and DVD drives with a SuperDisk drive ($165), a second hard disk ($275 for a 4GB unit), or a second battery ($120). Software DVD playback is adequate.

With its Celeron/433 processor and 64MB of memory, the FutureMate performed reasonably well on our benchmark tests, managing average scores. The machine comes with a basic one-year parts-and-labor warranty. (FutureTech Systems Inc., Hackensack, NJ; 800-275-4414, 201-488-4414; *www.futuretec.com.*)

The only system in this category using a Mobile PII/333 CPU, the 7.2 pound **Gateway Solo 2500 LS** targets everyone from business professionals to students. Its price ($2,199 direct) is somewhat high for a mainstream notebook offering only a 13.3-inch screen and a CD-ROM (as opposed to DVD-ROM) drive, but the fine support and excellent battery life may be worth the premium.

Like the Latitude, the Solo 2500 LS has a removable hard disk. You don't have the option of swapping other drives, however, because the floppy disk drive and CD-ROM drive are integrated. The unit comes with a great collection of ports, including the essentials: two USB ports, an IR port, and an S-Video port. And Gateway bundles a collection software, including Corel WordPerfect Suite 8 Professional, Grolier Multimedia Deluxe 1999, and LapLink Professional. Another nice extra—which none of the other mainstream systems offer—is a set of headphones.

The Solo 2500 LS scored an amazing 5:31 on our BatteryMark test. Gateway provides an array of detailed documentation—printed, installed, and on the Web. The Web site also provides a Technical Assistant, which, like Dell's Ask Dudley!, lists possible solutions to user problems. Gateway supports all Solo 2500 LS's with a one-year parts-and-labor warranty; a



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Using the same basic design as the Celeron-based OmniBook XE2 reviewed in our value category, the $2,200 configuration of the **HP OmniBook XE2**—equipped with a Pentium II/333, a 13.2-inch TFT display, and a 6.1GB hard disk—compares favorably with most all of its mainstream category competitors. Floppy disk drive, a 24X CD-ROM drive, and a 56-Kbps modem are integrated, but the system is still fairly thin and light, measuring 1.75 inches thick and weighing 7 pounds. Further equipped with HP's on-system help tools, this is a well-rounded and thoughtfully designed machine.

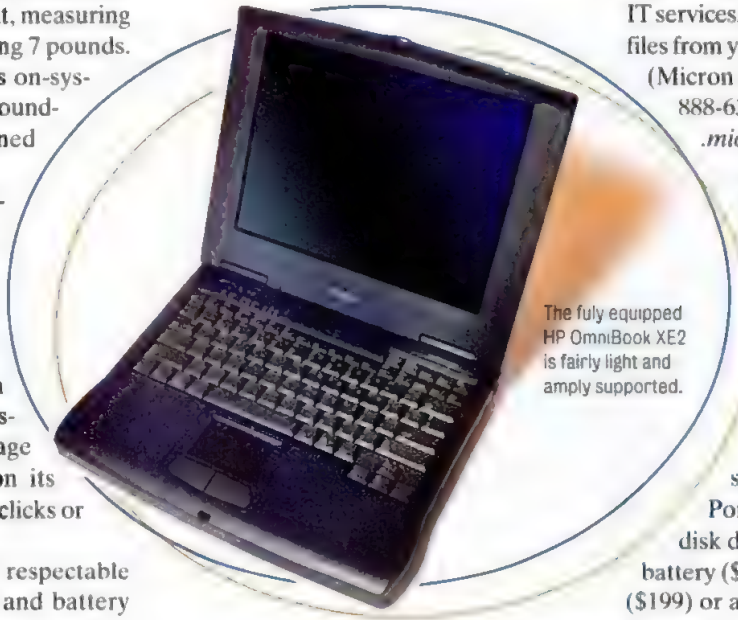
With speakers that protrude on either side of the system and translucent blue external CD-ROM controls, the XE2 is unusual looking and well equipped to play audio CDs—even when powered down. The system's keyboard is of average quality, but you can tap on its touch pad to perform mouse clicks or double clicks.

The machine turned in respectable scores on our performance and battery tests. HP backs the system with only a one-year warranty but supplies ample support via software—including a Windows 98 tutorial, an easy-to-browse user guide, and a Working in Comfort guide—as well as round-the-clock technical support. Few sub-$2,500 machines are so complete. (Hewlett-Packard Co., Santa Clara, CA: 800-752-0900, 970-635-1000; *www.hp.com.*)

We found the **IBM ThinkPad 390E** ($2,300 street) rather expensive for what it delivers. For this price, the 7.5-pound configuration includes just 32MB of RAM, a PII/300 CPU, and a 13.1-inch screen; others at this price deliver 64MB of RAM, 400-MHz processors, and 14-inch screens. Handy applications and system maintenance tools might sway corporate buyers who have standardized on an IBM fleet, but overall we prefer the offerings from Compaq, Dell, HP, WinBook, and others.

The ThinkPad 390E case offers a removable battery and combination floppy disk/CD-ROM drive, and the system ships with an extensive bundle of Internet tools, such as an Internet connection wizard and IBM HomePage Creator. Other applications on the system include PC-Doctor (a diagnostics utility) and ConfigSafe, which can capture an image of your system settings so you can revert to a previous configuration in case of a problem.

IBM provides a one-year parts-and-labor warranty that includes depot repair service and toll-free technical support.



The fuly equipped HP OmniBook XE2 is fairly light and amply supported.

During the warranty period, an IBM customer has access to Update Connector, which will notify you, via IBM's Help Center Web site, if there are any new drivers or other updates for your system. On-site service is $49 per year. (IBM Corp., Armonk, NY; 800-426-2968; *www.ibm.com.*)

Most of what Micron sells is targeted toward the small and medium-size business market, and the **Micron TransPort TREK^2** ($2,099 direct) is no exception. The 7.9-pound machine is built around a Celeron 400-MHz processor and has a lot to offer the mainstream user: useful features, comprehensive support, and solid performance.

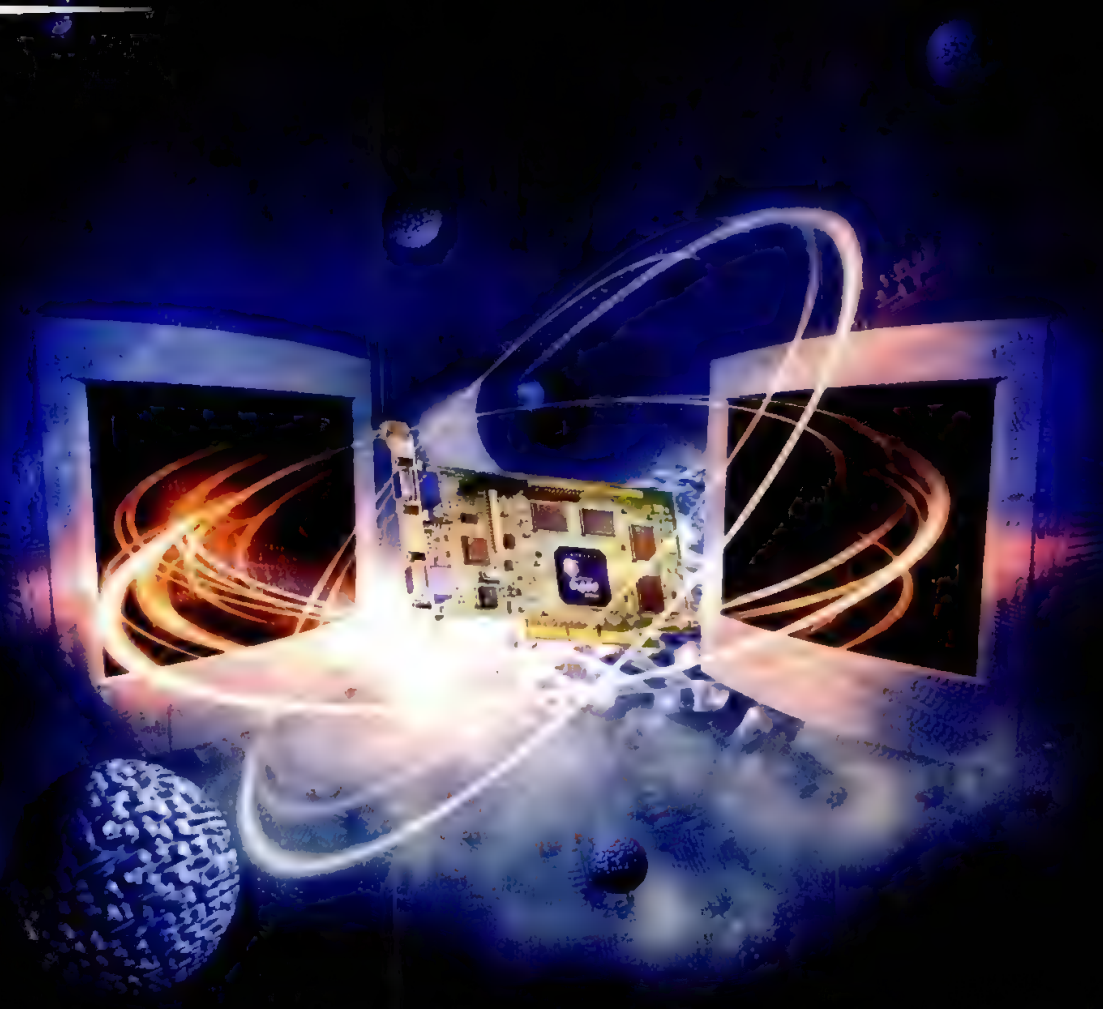
All the TREK^2's drives and its battery can easily swap out—without needing a screwdriver. The SMART lithium ion battery offers LEDs that light up to show you how much charge is left in the battery. Other useful features include two USB ports and an S-Video port.

The TREK^2 did well on our benchmark tests, posting mostly average scores. Micron loads the system with Microsoft Office 97 Small Business Edition and Norton Anti-Virus. The bundled Internet Wizard includes 50 free hours of Internet access. Along with a standard warranty of a generous three years for parts and labor, you get a year of classes at Micron University. For additional fees, Micron has other convenient support options, such as the Advance Portable Exchange program and IT services. The company will also transfer files from your old system to your new one. (Micron Electronics Inc., Nampa, ID; 888-634-8799, 208-893-3343; *www.micronpc.com.*)

PC Notebook packs a lot into the 7.3-pound **Cheetah IIc Pro** ($1,999 direct)—the only system in the mainstream category with a 466-MHz Intel Celeron processor. The Cheetah's sleek silvery green case has a 14.1-inch TFT display and all the I/O ports included (two PC Card slots, two USB ports, and an IR Port, among others). The floppy disk drive slides out to hold an extra battery ($179), an extra 4.3GB hard disk ($199) or a SuperDisk drive ($149). Like Compaq, Gateway, and Micron, PC Notebook bundles Corel WordPerfect Suite 8.

The Cheetah IIc Pro did fairly well on our performance tests (especially considering the price), though battery problems prohibited us from completing our drain tests. The company expects to have a new SMART lithium ion battery as standard issue by the time your read this. PC Notebook's support services don't differ much from some of the larger vendors in this category—a welcome surprise from a smaller vendor. The Cheetah IIc Pro is backed by a one-year parts-and-labor warranty as well as lifetime toll-free telephone and online technical support. Unlike the big guys, however, the Web site offers just driver updates, and the telephone technical support is available only six days a week. (PC Notebook Inc., Midvale, UT; 888-962-4600, 801-565-8027; *www.pcnotebook.com.*)

If you need just the basics at a reasonable price, check out the **Toshiba Satellite**



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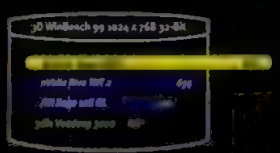

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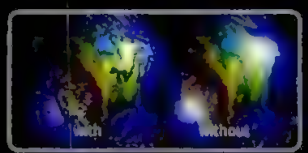

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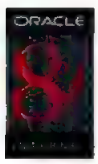

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4030CDT. For $1,800 street, you get Toshiba's proven record as a notebook vendor and a light (6.7-pound), well-equipped system. This Satellite doesn't offer as much flexibility as some others, as the hard disk, floppy disk drive, and CD-ROM drive are fixed internal components—but that can be forgiven considering the price.

The Micron TransPort TREK² delivers useful features and solid performance.

The keyboard and palm rest made this unit comfortable to use, and Toshiba's Fn-Esse tool (which assigns short cuts to Function + key combinations to quickly launch your favorite programs) is a plus. Performance from the Mobile Celeron/300 processor was average, as was its battery life of 2:33.

The Satellite 4030CDT comes bundled with Norton AntiVirus and an Internet connection wizard, which gives you no-risk, free access for 30 days with AT&T. The unit's standard warranty includes one year of parts and labor. Toshiba offers 24-hour, 7-day toll-free technical support, 32-hour in-depot repair cycle, support for bundled software, and the ability to troubleshoot system problems remotely. All Toshiba customers can access comprehensive support on the Toshiba Web site: Along with drivers, online forums and bulletin boards, Ask IRIS Online will provide you with instant answers to your technical questions. (Toshiba America Information Systems Inc., New York, NY; 888-598-7802, 714-583-3000; *www.csd.toshiba.com.*)

The price tag of the 7-pound **WinBook XL² C400** ($2,137 direct) is on the high side for this category, but it comes equipped with a Celeron/400 processor and a large, 14.1-inch screen. It was an excellent performer on our benchmark tests, which makes it worth a look.

The user manuals (both printed and on the hard disk) are organized and well written. The XL² C400 possessed all the necessary I/O ports, even an IR port, S-Video port, and TV-out port. The case offers an ample palm rest and an ergonomically placed touch pad. The DVD and floppy disk drives do not swap for other components, though the hard disk can be swapped for a larger one. In DVD playback, sound was excellent, though picture quality showed fuzziness on close-ups.

The XL² C400 was one of the best performers on our benchmark tests, and its battery life of 3:08 was above average. WinBook supports the unit with a standard one-year parts-and-labor warranty, lifetime toll-free technical support, and e-mail updates with new drivers. For $299, you can purchase a three-year parts-and-labor PremiumCare warranty, which includes FedEx Priority overnight pickup and delivery. (WinBook Corp., Columbus, OH; 800-651-4518; *www.winbook.com.*)

Desktop Replacement NOTEBOOKS

BY CADE METZ

After a year of significant improvement in mainstream notebook hardware, the term desktop replacement—typically used to describe the market's fastest, best-equipped portables—is not the misnomer it once was. Many people can—and do—use high-end notebooks in place of desktop PCs. And though their size and weight make these machines less ideal as road-going, connect-anywhere companions, they are the right choice for a branch-office or home-office professional who wants one machine with the power of a desktop plus portability when necessary.

Whereas most of the other notebook categories covered in this issue are fairly homogenous, desktop replacements are divided into three distinct types: the 9- to 10-pound machine, equipped with both DVD and floppy disk drives (such as the Dell Inspiron 7000 A400LT); the 7-pound system, which offers internal DVD and floppy disk drives but uses a smaller hard disk and a smaller display (such as the NEC Versa LX); and the 5- to 6-pound machine, whose floppy disk drive must be used externally or in lieu of the unit's DVD drive (such as the IBM ThinkPad 600).

Arguments over the merits of Apple machines versus Wintel PCs may never be settled, but one thing is certain: The latest 400-MHz **Apple PowerBook G3** ($3,500 street) is a potent, highly portable laptop. Weighing 7.1 pounds, the PowerBook includes a 14-inch display, a 6.4GB hard disk, a DVD drive, a 56-Kbps modem, a 10/100 Ethernet adapter, and an external SCSI port. It lacks a floppy disk drive—à la the iMac—and is obviously designed for travelers, but the unit can easily double as a desktop replacement system as well.

The PowerBook is certainly more attractive than most notebooks. The casing is black and reflective, its edges are rounded, and its keys are translucent. And unlike many popular systems, the PowerBook offers a simple, easy-to-use power management (PM) scheme. The PM options are limited, however, and the system takes quite a while to resume from suspend mode. Perhaps the system's only significant drawback is its one-year warranty, which does not afford on-site service. But documentation and software help tools are superb, as is Apple's Web-based support. (Apple Computer Inc., Cupertino, CA; 800-795-1000; *www.apple.com.*)

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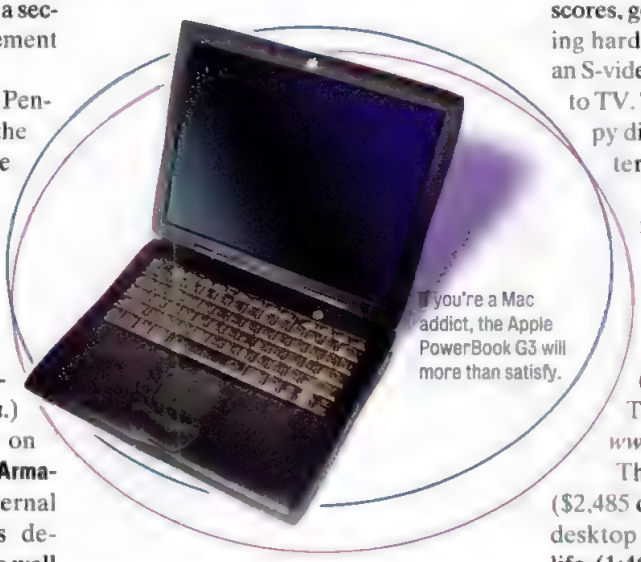
To get all the facts and figures on Windstar, visit www.fordvehicles.com

Brick Computer's **Brick Ergo BigScreen^5** ($3,895 direct) is a large but powerful portable, offering a 15-inch TFT display, a 13.4GB hard disk, and a DVD drive. Using essentially the same chassis design as the Micron TransPort NX reviewed below, this 366-MHz Pentium II machine houses a floppy disk drive that can be swapped for a SuperDisk drive ($100), an Iomega Zip 250 Drive ($250), a second hard disk ($295 for 2GB), or a second battery ($170). The only element missing is an integrated modem.

Competing with many 400-MHz Pentium IIs in this category, the BigScreen^5 scored just above average during Business Winstone 99 testing. Its BatteryMark 99 score, however, was low, at 1:55. Selling systems directly to end users and through dealers, Brick includes a four-year warranty. (The Brick Computer Co., Peabody, MA; 800-495-3746; *www.ergo-computing.com.*)

Unlike most other notebooks on the market, the 6.7-pound **Compaq Armada 7800** ($4,500 street) uses an internal AC adapter. Unfortunately, this deprives the Armada of a palm rest as well as an extra spindle. Refreshingly, Compaq's power management scheme is quite good, letting you govern all settings and functions via Windows. The system's only major flaw is its lack of a third spindle. You can, however, easily remove its DVD drive and install a floppy disk drive, a SuperDisk drive ($219), a second hard disk ($950 for 8GB), or a second battery ($186).

Equipped with a Pentium II/400 and a less-than-ideal S3 graphics engine, the Armada performed reasonably well on Business Winstone 99 but dragged a bit during Graphics WinMark 99 testing. On the other hand, the system had a respectable battery life of 3:24. The Armada ships with a three-year parts-and-labor warranty and benefits from a generous collection of support tools. (Compaq Computer Corp., Houston; 800-345-1518, 281-370-0670; *www.compaq.com.*)



If you're a Mac addict, the Apple PowerBook G3 will more than satisfy.

Sharing its basic design with the MAG, MidWest Micro, Quantex, and Sceptre systems reviewed here, the **Dell Inspiron 7000 A400LT** ($3,592 direct) is a step above these immediate competitors—mainly because of Dell's renowned service policies—and is an Editors' Choice. Equipped with a 400-MHz Pentium II, a 15.3-inch display, a 13.4GB hard disk, and 8GB of graphics memory, the 9.4-pound Inspiron is a handful. But it delivered fairly fast benchmark test scores, good battery life (3:51), outstanding hardware-decoded DVD video, and an S-video port that exports DVD movies to TV. The front bay houses a dual floppy disk/DVD drive, or a second battery ($119), or a Zip Drive ($139).

Dell offers a three-year warranty, a year of on-site service, 30 days of free Internet access, and a system-specific "Express Service Code" for quick technical help on the company's Web site. (Dell Computer Corp., Austin, TX; 800-388-8542, 512-338-4400; *www.dell.com.*)

The inexpensive **FOSA AP 2100P** ($2,485 direct) is worth considering as a desktop replacement, but short battery life (1:46) should make travelers think twice. The package includes a 14-inch display, a 9.5GB hard disk, and a DVD drive. The AP 2100P integrates two multipurpose drive bays. The bay that normally houses a floppy disk drive can also be used for a SuperDisk drive ($170), a second hard disk ($240), or a second

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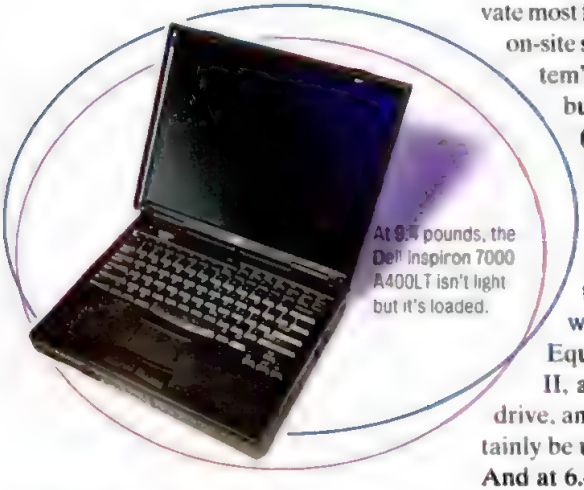
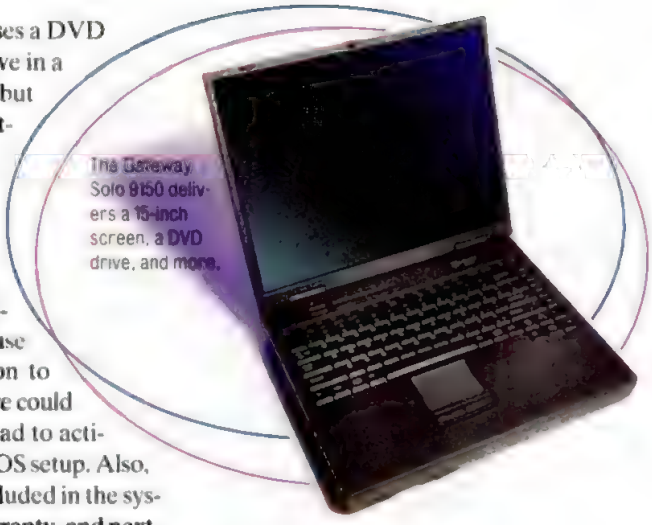
battery ($155). With the DVD drive in place, video playback—reliant on software decoding—is good but not excellent. The S-Video port can export DVD playback to a TV.

The machine performed well on other benchmark tests. FOSA backs this system with a one-year warranty. (FOSA Computer Inc., South Plainfield, NJ; 800-216-3672, 908-753-6100; *www.fosa.com*.)

Weighing over 8.7 pounds, the **Gateway Solo 9150** ($4,049 direct) is a hefty but powerful machine in the vein of the Dell Inspiron 7000 A400LT. Equipped with a 400-MHz Pentium II, a 15-inch display, a 13.4GB hard disk, and 8MB of graphics memory, it produced our roundup's highest Winstone score, and it will run for 3:45 on battery power.


At 9.4 pounds, the Dell Inspiron 7000 A400LT isn't light but it's loaded.

This unit typically houses a DVD drive and a SuperDisk drive in a front-accessible drive bay but can also take a second battery($150) or a Zip Drive ($119). Driven by a hardware decoder, DVD playback is brilliant. One drawback is the Solo 9150's subpar power management setup. We could use the system's power button to suspend and resume, but we could not suspend to disk and had to activate most features with BIOS setup. Also, on-site service is not included in the system's three-year warranty, and next-business-day service costs extra. (Gateway, North Sioux City, SD; 800-846-2000, 605-232-2000; *www.gateway.com*.)


The Gateway Solo 9150 delivers a 15-inch screen, a DVD drive, and more.

The **HP OmniBook 4150** ($3,800 street) delivers an attractive mix of power and lightweight for this category. Equipped with a 400-MHz Pentium II, a 14-inch TFT display, a DVD drive, and a 10GB hard disk, it can certainly be used as a desktop replacement. And at 6.4 pounds, the unit is also light enough to double as a traveling machine. The system uses a two-spindle design, letting you substitute a floppy disk drive, a second battery ($209), or a SuperDisk drive ($219) for its DVD module. The unit lacks only an integrated modem.

The OmniBook 4150 posted average scores, including a 2:40 on the BatteryMark test. Now providing the helpful software-based OmniBook library as well as 24-hour, 7-day-phone support, HP's support services are nearly as impressive as its hardware. (Hewlett-Packard Co., Santa Clara, CA; 800-752-0900, 970-635-1000; *www.hp.com*.)

The **IBM ThinkPad 600E** ($4,100 street) is comparable to the HP OmniBook 4150—but it's more impressive. It's an Editors' Choice in this category, but note that it qualifies as a road-going, thin and light machine as well. Measuring 1.5 inches thick and weighing only 5.6 pounds, this sleek system is ideal for travel yet equipped for the desktop. The ThinkPad 600E's floppy disk drive must

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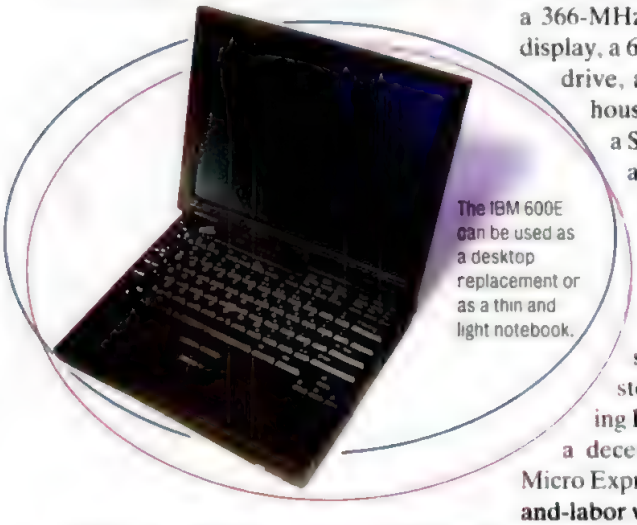
be used externally or in lieu of its DVD drive, but the system integrates a host of desktop-level components, including a 400-MHz Pentium II, a 56-Kbps modem, 9.5GB of storage space, and a 13-inch TFT display. The included DVD drive can be swapped for a Zip Drive ($329), a second hard disk ($729 for 6.4GB), or a second battery ($255).

Like Compaq, IBM has moved all of its power management functions to Windows, making these functions easier to use than those of most other notebooks—and much more powerful as well. You can readily regulate the operation of the unit's CPU, CD-ROM drive, and PCI Bus. A good performer with fine battery life (3:24), the ThinkPad 600E is a near-perfect portable. Support includes a customized Internet dialer, the helpful "Access ThinkPad" Windows shell and documentation library, and a one-year warranty. (IBM Corp., Armonk, NY; 800-426-2968, 914-766-1900; *www.ibm.com*.)



The IBM 600E can be used as a desktop replacement or as a thin and light notebook.

The 9.2-pound **MAG Verity 8536CDT** ($3,000 street) is a potent machine with a reasonable price. Using the same basic chassis design as the Dell, MidWestMicro, Quantex, and Sceptre machines reviewed here, the Verity typically houses a dual floppy disk/DVD module, but you can also use a second battery ($215) or a Zip Drive (price not available).

Like the Inspiron, the Verity integrates a 15-inch TFT display, a modem, ATI Rage LT Pro graphics, and an S-Video port. But all things considered, the Verity doesn't quite measure up to the Dell model. Slightly cheaper, it delivers only a 366-MHz Pentium II and 6.1GB of storage space. With its slower processor, the Verity scored slightly lower under Winstone but higher on our BatteryMark test (3:20). And unlike Dell, MAG backs the system with only a one-year warranty and provides neither on-site service nor round-the-clock support over the phone. (MAG Portable Technologies, Santa Ana, CA; 800-533-7515; *www.magportables.com*.)

The 8.4-pound **Micro Express MP6366V** isn't quite as cumbersome as the Inspiron, but the unit still includes an impressive collection of hardware for the price: a 366-MHz Pentium II, a 15-inch TFT display, a 6.1GB hard disk, a floppy disk drive, and a multipurpose bay that houses the included DVD drive or a SuperDisk drive ($199). Priced at only $2,000 direct, the Micro Express unit is a bargain with much to recommend it.

Despite a slower CPU than those of many competing machines, the MP6366 still produced an average Winstone score and lasted 3:20 during BatteryMark testing, making it a decent option for the road, too. Micro Express includes a four-year parts-and-labor warranty and round-the-clock phone support. (Micro Express, Irvine, CA; 800-989-9900, 949-852-1400; *www.microexpress.net*.)

Quite similar to the Brick Ergo BigScreen[5] portable reviewed above, the **Micron TransPort NX** ($3,499 direct) fits the classic desktop replacement mold, offering a 15-inch TFT display, a 366-MHz Pentium II, a 13.4GB hard disk, and a DVD drive in an 8.8-pound package. The system lacks an integrated modem, but you can readily replace its DVD drive with a SuperDisk ($139), a Zip Drive ($149), a second hard disk ($299 for 6.4GB), or a second battery ($109). Unlike the Brick unit, the TransPort NX benefits from Micron's unique software add-ons and service policies, which put this system among the market leaders.

Though split between Windows and BIOS, the TransPort NX's power management scheme is easy to use. There are separate hotkeys for suspend-to-RAM and suspend-to-disk, and each works as it should. Despite using a 366-MHz rather than a 400-MHz CPU, the TransPort NX

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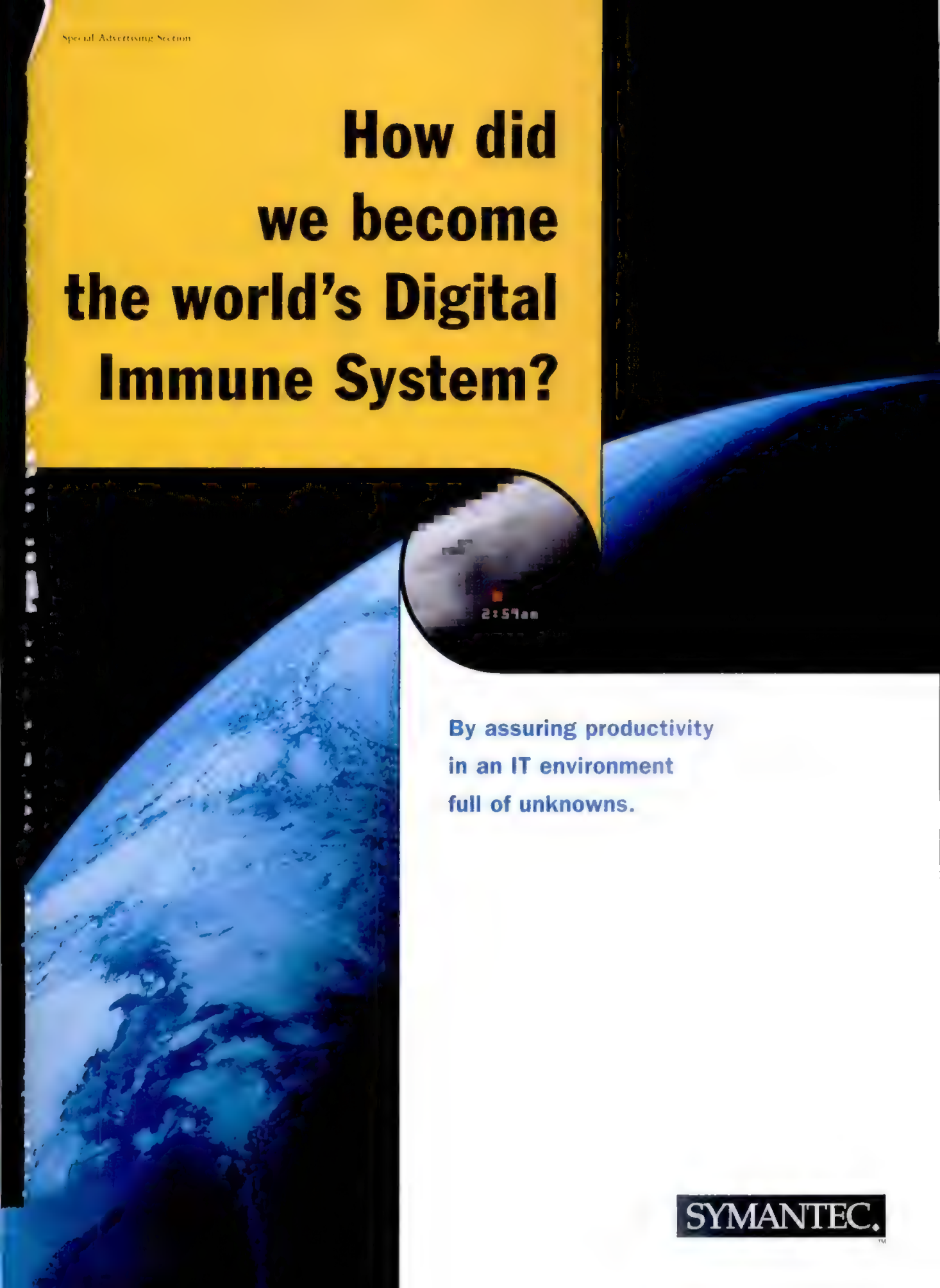

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Desktop Configurations	Norton Ghost, pcANYWHERE
Remote Systems Operation	pcANYWHERE
Management of Remote Users	Digital Immune System Administrator
System Recovery	Norton Ghost, pcANYWHERE

maintain their Service Level Agreements, increase end-user productivity, and – because installation, management, and administration is so easy – total cost of ownership is greatly reduced as well. Release of a Digital Immune Ready version of Norton SpeedDisk is targeted for the first half of 2000.

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09-71-00326

was a slightly-above-average performer, benefiting from an ATI Rage LT Pro graphics chip set. Its BatteryMark score was a respectable 3:04.

The company includes Microsoft Office Small Business Edition, a year's worth of computer-related classes from the Web-based Micron University, an Internet wizard, 30 hours of free Internet time, and a three-year warranty with on-site service. (Micron Electronics Inc., Nampa, ID; 888-634-8799, 208-893-3343; *www.micronpc.com*.)

Yet another machine resembling the Inspiron, the 9.2-pound **MidWest Micro Solis** ($3,199 direct) incorporates an imposing array of hardware. Though this Pentium II/400 doesn't offer as much storage space as the Inspiron (9.6GB versus 13.4GB) and lacks Dell's supplementary offerings, it is otherwise comparable to the Dell system.

The Solis has a front multipurpose drive bay that houses both floppy disk and DVD drives. Driven by a hardware-based decoder, DVD playback is exemplary, and movies can easily be exported to your TV via an S-Video jack. Other options for the bays are a second battery ($129) or a SuperDisk drive ($149). The system also integrates a 15-inch TFT display, a 56-Kbps modem, and an external volume knob.

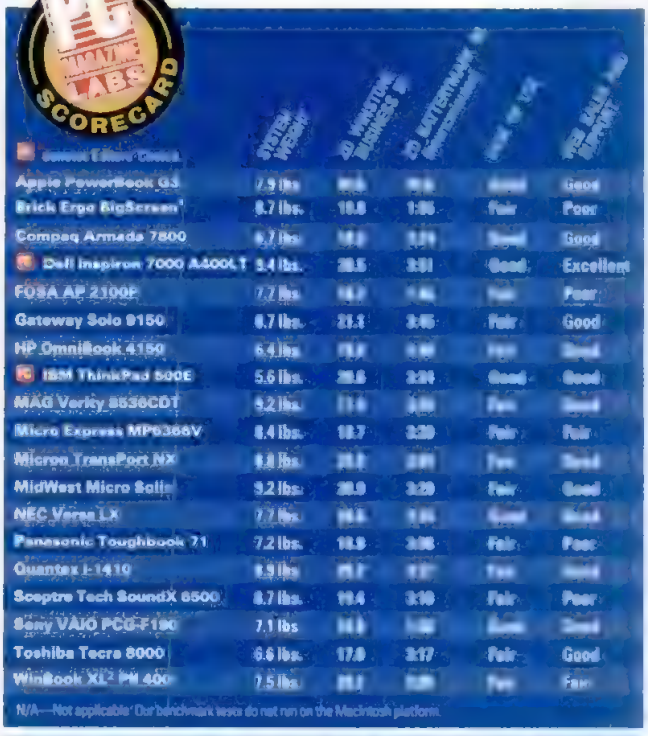
The Solis scored near the head of the pack during Winstone testing and lasted a commendable 3:29 on our BatteryMark test. MidWest Micro provides limited documentation for the system and a mere one-year warranty. (MidWest Micro, Fletcher, OH; 800-626-0544, 937-368-2309; *www.mwmicro.com*.)

The **NEC Versa LX** ($4,600 street) is a surprisingly thin 7.7-pound, three-spindle notebook that is worth a look. Equipped with both SuperDisk and DVD drives, as well as a Pentium II/400 and 8MB of graphics memory, it shares many of its parts with sibling Versa SX—a plus for IT managers purchasing different models for different employee needs. The system lacks only an internal modem.

The Versa LX's hot selling point is its Versa Bay, which holds a DVD drive or a second hard disk, both of which are warm-swappable (you can install or remove them while the system is in suspend mode). Its battery life scored a respectable 3:34, and the machine was a fine performer on other tests as well.

Backed by a three-year parts-and-labor warranty and round-the-clock technical support, the Versa LX suits the frequent traveler and the power user. (NEC Computer Systems Division, Boxborough, MA; 888-863-2669, 508-264-8000; *www.nec-computers.com*.)

In a notebook market populated by so many clones and near clones, the aptly named **Panasonic Toughbook 71** ($3,599 direct) is a unique machine. Equipped with a thick magnesium case, a shock-mounted hard disk, and a vibration-resistant LCD, this fairly small two-spindle machine is built to endure rough treatment.



The Toughbook includes a Pentium II/366, a 13-inch display, a 9.5GB hard disk, and a removable DVD drive. You can easily replace the latter with a floppy disk drive—which can also be used externally—or a SuperDisk drive. With the DVD drive installed, video playback, which is dependent on software decoding, is average.

The Toughbook isn't a particularly fast machine, but it performed as well as most Pentium II/366s. At 3:08, battery life was acceptable. Panasonic has fashioned the ultimate in a small-but-rugged notebook and backs this impressive piece of hardware with three-year warranty and round-the-clock technical support. (Panasonic Communications and Systems Co., Secaucus, NJ; 800-211-7262; *www.panasonic.com*.)

Though it has a 14-inch display and offers only 7.8GB of storage space, the **Quantex I-1410** ($2,927 direct)—like so many systems reviewed here—has a chassis very similar to that of the Dell Inspiron 7000 A400LT. At 8.9 pounds, the I-1410 is slightly smaller and lighter than the Inspiron, but it too integrates a dual floppy disk/DVD drive, an ATI graphics chip set with 8MB of memory, a 56-Kbps modem, an S-Video port, and an external volume control.

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decoder, the unit affords exemplary DVD playback; you can also export video to your television, or you can easily swap its floppy disk/DVD module for one of several optional devices. Battery life was a respectable 3:37, and other performance attributes were average for this class. Quantex backs the system with a three-year warranty and round-the-clock technical support but does not provide on-site support. (Quantex Microsystems Inc., Somerset, NJ; 800-346-6572, 732-563-4166; *www.quantex.com.*)

The last of our roundup's five Inspiron look-alikes, the **Sceptre Tech SoundX 6500** ($2,399 direct) offers hardware-based DVD playback from a familiar, three-spindle chassis. This system isn't as powerful or as well supported as the Dell or the Quantex units in this category, but it's effective and inexpensive. Like the Quantex I-1410, the SoundX includes a 14- rather than a 15-inch display and weighs closer to 9 pounds rather than 10 pounds when coupled with an AC adapter. Other elements are the same, including an S-Video port, a volume-control knob, and a removable floppy disk/DVD drive module that can be replaced with a second battery or a Zip Drive.

Its battery life of 3:10 was a touch below similar models but still acceptable, as were other benchmark test results. Unfortunately, Sceptre provides only a one-year warranty and limited technical support over the phone. (Sceptre Tech Inc., City of Industry, CA; 800-788-2878, 626-369-3698; *www.sceptre.com.*)

Part of the company's consumer-centric line, the **Sony VAIO PCG-F190** ($3,100 street) isn't as thoroughly equipped as the Dell or as portable as the IBM ThinkPad 600E, but the machine is ideal for home users interested in the Web and PC multimedia. Equipped with an IEEE 1394 port—capable of importing images directly from a digital video camera—and an extensive collection of imaging, audio, and Internet software, the PCG-F190 is certainly a capable PC as well, offering a Pentium II/366, a 6GB hard disk, a floppy disk drive, and a DVD drive.

Colored gray and soft purple like all VAIO systems, the PCG-F190 is well constructed and easy to use. You can purchase a second battery ($250) for use in place of the floppy disk drive. The unit had a low BatteryMark score of 1:58, even though it's one of the few machines to comply with the new ACPI (Advanced Configuration and Power Interface) specification. The unit was a below-average benchmark test performer, however.

Sony includes some system configuration tools, an Internet wizard, and 50 hours of free Internet access. The company warranty covers only one year (or 90 days if you don't return the registration card). (Sony Electronics Inc., San Jose, CA; 888-476-6972; *www.sony.com.*)

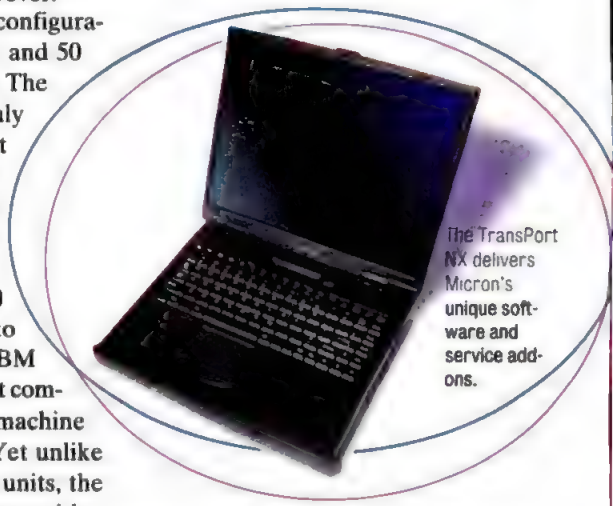
The **Toshiba Tecra 8000** ($4,360 street) is comparable to the HP OmniBook 4150 and IBM ThinkPad 600E, against which it competes. It, too, is a two-spindle machine that weighs under 7 pounds. Yet unlike the HP or the IBM ThinkPad units, the Tecra 8000 provides IT managers with a significant advantage: The unit is available in several thousand different configurations, but it always uses the same motherboard and chassis. This makes it easier for a corporation to standardize on one platform. Though the Tecra 8000 can't concurrently accommodate a floppy disk drive and a DVD drive, it's worth close consideration.

The Tecra 8000 offers a Pentium II/366, a 14-inch TFT display, and 7.8GB hard disk, but it does lack an integrated modem. The bay housing the system's DVD drive can take a CD-ROM drive, a floppy disk drive, a SuperDisk drive ($199), a Zip Drive ($199), a second hard disk ($579 for 4GB), or a second battery ($269).

With a 3:17 battery life and a 6.6-pound weight, the Tecra 8000 is meant for the road. In addition, the system provides good DVD playback and average benchmark test performance. This groundbreaking machine is backed by a three-year warranty. (Toshiba America Information Systems Inc., New York; 888-598-7802, 714-583-3000; *www.computers.toshiba.com.*)

Well known for the inexpensive portables it sells at the value end of the market, WinBook Computer Corp. also sells competent systems at the high end. Priced at $3,339 (direct), the **WinBook XL² PII 400** compares well with the other sub-8-pound, three-spindle systems reviewed here, offering a Pentium II/400, a 14-inch display, a 9.6GB hard disk, a SuperDisk drive, a DVD drive, and two pointing devices.

The software-based DVD playback


The TransPort NX delivers Micron's unique software and service add-ons.

was reasonably good, and the system performed slightly above average during benchmark testing. Its BatteryMark score of only 3:08 was acceptable for the class. The company backs the system with a one-year warranty and limited technical support over the phone. (WinBook Corp., Columbus, OH; 800-651-4518; *www.winbook.com.*)

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EVEREX

Value NOTEBOOKS

By Jon Hill

One of the fastest-growing segments of the notebook PC market is the value segment. With prices around $1,500 (and as low as $1,200), they are enabling users who would have otherwise been able to afford only a desktop system to get connected anywhere: students, small-business users on a budget, and home users looking for a powerful enough machine that can also go with them on the patio or on vacation.

Can you get something that will fit your needs in this price range? The answer is probably yes. Chip prices are falling on everything from CPUs to 3-D audio and graphics accelerators, and the result is an abundance of worthy machines at reasonable prices.

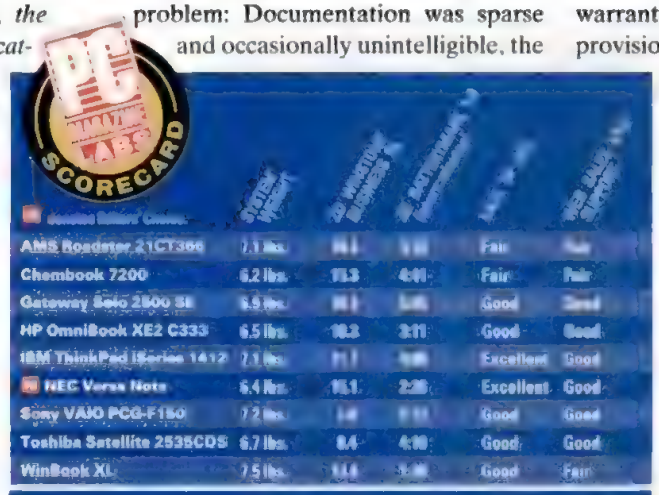
With one or two exceptions, the notebooks that fall into the value category are similar in size and weight to each vendor's mainstream offering. In general, the value notebooks have smaller screens (12.1-inch versus 13-inch), Celeron or AMD K6-2 processors rather than price-premium Pentium II processors, and smaller hard disks. Most of the units came configured with 32MB of system memory; we recommend upgrading to at least 64MB to optimize performance. The machines are not especially thin or light—averaging about 7 pounds—but each is a complete three-spindle unit, with built-in modem, floppy disk drive, hard disk, and CD-ROM drive.

The **AMS Roadster 21CT366** ($1,600 street) was a bit of a paradox. On paper, this 7-pound machine with 32MB of SDRAM and an AGP-based ATI Rage LT Pro graphics accelerator looks great, but in reality it was a disappointment on our benchmark tests. Thus, this unit is difficult to recommend for home buyers, and its lack of service options will keep it from being a factor in the corporate market.

The Roadster's scores were below average. On our CPUmark 99 tests, the Roadster's 366-MHz Celeron processor was outperformed by 333-MHz and 300-MHz Celeron and Pentium II processors. The unit's Business Disk WinMark 99 and Winstone 99 scores were near-bottom for this category, and the Business Graphics WinMark 99 score was little better than half that of other Rage Pro LT–based systems. To its credit, the Roadster was one of the few notebooks able to complete our 3D WinMark tests, and its battery life of 3:10 was respectable. We recommend a driver update for the ATI Rage Pro LT and suspect that an unknown bug in the unit's flashable SystemSoft BIOS is affecting the CPU's performance.

Test performance wasn't the only problem: Documentation was sparse and occasionally unintelligible, the Flexmark keyboard has a poor layout, and the 12.1-inch TFT screen was a bit dark and afforded limited brightness and contrast range. AMS provides a three-year warranty on parts and labor but offers no provision for on-site service, nor does the company provide 24-hour, 7-day technical support. (AMS Technology, Irwindale, CA; 818-814-8851; *www.amsnote.com.*)

The Gateway Solo 2500 SE is affordable and feature-rich but not fast.



At 6.2 pounds, Chem USA Corp.'s **ChemBook 7200** ($1,499 direct) is noticeably lighter than the other value notebooks we reviewed, and at 1.5 inches, it was among the thinnest as well. Aided by a healthy 64MB of SDRAM, the 300-MHz Mobile Celeron–based ChemBook outperformed several nominally faster systems, posting the highest Business Winstone 99 score in the value category. We were unimpressed with the unit's keyboard, but if you're looking for a fast, light three-spindle notebook, the ChemBook 7200 is an affordable contender.

The ChemBook's Flexmark keyboard bounces up and down while you type, and the Spacebar was lower than its letter keys. The unit's 12.1-inch screen, however, was clear and bright. The lithium ion battery powered the system for an exceptional 4:41 on our BatteryMark test. Overall performance was outstanding: best-in-category on Business Win-

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HEWLETT® PACKARD

SUMMARY OF FEATURES

Notebook PCs

MINI-NOTEBOOK
THIN & LIGHT
MAINSTREAM
■ YES □ NO

PC MAGAZINE EDITORS' CHOICE

	Fujitsu LifeBook B112	IBM ThinkPad 240	Sony VAIO C1 PictureBook	Toshiba Portégé 3020CT	Alcam Executive 700	Compaq Presario 1925	Fujitsu LifeBook L470	Gateway Solo 3150 LS
Price of tested configuration	$1,599 direct	$2,000 street	$2,300 street	$1,900 street	$1,899 direct	$3,300 street	$3,099 direct	$2,924 direct
System weight/Travel weight* (pounds)	2.8 / 3.5	2.9 / 3.7	2.4 / 2.9	2.8 / 3.5	4.4 / 5.1	5.0 / 5.7	4.3 / 5.3	5.1 / 6.0
Dimensions (HWD, in inches)	1.3 x 9.1 x 6.8	1.5 x 10.2 x 8.0	1.5 x 9.5 x 5.5	1.0 x 10.0 x 8.8	1.3 x 8.8 x 11.6	2.5 x 11.5 x 9.5	1.1 x 11.9 x 9.4	1.3 x 11.3 x 8.5
Processor	Pentium MMX/233	Mobile Celeron/300	Pentium MMX/266	Mobile Pentium MMX/300	Mobile Pentium II/300	Mobile Pentium II/400	Mobile Pentium II/366	Mobile Pentium II/400
Chip set	Intel 430TX	Intel 440BX	Intel 430TX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX
Installed/maximum system RAM	32MB / 96MB	64MB / 192MB	64MB / 128MB	32MB / 96MB	64MB / 160MB	64MB / 192MB	64MB / 192MB	64MB / 160MB
Installed pipelined-burst cache	512K	128K	256K	512K	512K	256K	256K	256K
Graphics chip set	NeoMagic MagicGraph 128XD	NeoMagic MagicGraph 128XD	NeoMagic MagicMedia 256AV	NeoMagic MagicGraph 128XD	ATI Rage LT Pro	NeoMagic MagicGraph 256AV	NeoMagic MagicGraph 128	NeoMagic MagicMedia 256AV
Graphics memory	2MB SDRAM	2MB SGRAM	2.5MB SDRAM	2MB SGRAM	4MB SGRAM	2.5MB SGRAM	2MB SGRAM	2MB SGRAM
Hard disk	Fujitsu MHD2032AT	IBM DBCA-206480	Fujitsu MHF2043AT	Toshiba MK-6411MAV	IBM DKLA-24320	IBM DCXA-210000	Fujitsu MHF2043AT	Toshiba MK-6411MAT
Capacity and interface	3.1GB ATA-3	6.2GB ATA-4	4.1GB ATA-4	6.2GB ATA-4	4.1GB ATA-4	9.5GB ATA-4	4.1GB ATA-4	6.1GB ATA-4
Floppy disk drive	External	External	External	External	External	Swappable	External	External
Floppy disk option	None	SuperDisk	None	None	None	SuperDisk	None	None
CD-ROM maximum speed	20X	20X	14X	24X	24X	24X	20X	24X
Price of DVD-ROM drive	N/A	N/A	N/A	N/A	$299 direct	Included	$499 direct	$200 direct
Built-in speakers/microphone	■□	■■	■■	■□	■■	■□	■■	■■
Line-in/line-out jack	□□	■□	□□	■□	□□	■■	■□	□□
Microphone/speaker jack	■■	■■	■■	■■	■■	■■	■■	□■
NTSC video-in/video-out	□□	□□	□■	□□	□■	□□	□□	□□
Infrared port/Ethernet port	■□	■□	■□	■□	■□	□□	■□	■□
Shared mouse/keyboard port	□	■	□	■	■	■	■	■
USB ports/IEEE 1394 ports	2 / 0	1 / 0	1 / 1	1 / 0	1 / 0	1 / 0	1 / 0	1 / 0
Price of port replicator	Included	N/A	N/A	Included	Included	$130 street	N/A	$100 direct
Price of full docking station	N/A	N/A	N/A	N/A	N/A	N/A	$499 direct	$599 direct
Modem	Integrated 56K	Integrated 56K	Integrated 56K	PC Card 56K	PC Card 56K	Integrated 56K	Integrated 56K	Integrated 56K
PC Card slot	Type II	Type II	Type II	Type II	Type III	Type III	Type II	Type II
CardBus/Zoomed video support	■■	■■	■■	■□	■■	■■	■■	■■
LCD-panel size and type	8.4" TFT	10.1" TFT	8.9" TFT	10.8" TFT	12.1" TFT	13.1" TFT	13.3" TFT	12.1" TFT
Screen resolution	800 x 600	800 x 600	1,024 x 480	800 x 600	800 x 600	1,024 x 768	1,024 x 768	800 x 600
Battery type	Lithium ion	Lithium ion	Lithium ion	Lithium ion	Lithium ion	Lithium ion	Lithium ion	Lithium ion
ACPI operational	□	□	□	■	□	□	□	□
Standard warranty on parts/labor	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1year	1 year/1 year	1 year/1 year	3 years/3 years	1 year/1 year
On-site service charge for first year	$49.95	$49.00	N/A	$79.00	N/A	N/A	$49.95	$79.00
24-hour, 7-day technical support	■	■	■	■	□	■	■	□
24-hour turnaround for parts	□	□	□	■	□	□	□	■

* System weight is the PC plus battery, with drive bays filled. Travel weight adds the AC adapter. N/A—Not applicable: The product does not have this feature.

stone 99 and quite respectable on our WinMark 99 Disk, Business Graphics, and CD-ROM tests. The ChemBook's Silicon Motion graphics accelerator does not provide 3-D acceleration, however.

Chem USA's standard warranty covers one year on parts and three years on labor, but you can choose a full three-year parts-and-labor warranty for an additional $150. Chem USA does not provide on-site service, but the company claims 48-hour turnaround on repairs. (Chem USA Corp., Newark, CA; 510-608-8818; *www.chembook.chemusa.com.*)

The **Gateway Solo 2500 SE** ($1,549 direct) offers a wealth of options and features, but the 333-MHz Mobile Celeron–based system's performance profile was lackluster. You have a host of reasons to choose a Gateway notebook—competitive pricing, an excellent software bundle, top-flight battery life, and the company's build-to-order policy come to mind—but speed freaks will undoubtedly want to add some memory to boost performance.

The 12.1-inch TFT screen is bright and clear, with a greater adjustable range than most. An on-screen control pops up to guide brightness and contrast adjustments. Documentation is excellent; novices will find the clear, logical guides especially helpful. Options include a 120MB SuperDisk ($75), a DVD drive ($150), and a set of docking options that include a full docking station ($599), a minidock ($199), and a port replicator ($100).

The 6.9-pound Solo 2500 SE lasted for over 5 hours on our BatteryMark test—the longest in this group by a wide margin. Other performance results were less than stellar, however: The 4.1GB Hitachi hard disk ranked slightly below average on our Disk WinMark 99 tests; its Neomagic MagicGraph 128XD graphics accelerator posted an average score on Business

See www.pcmag.com for interactive views

Continues

	HP OmniBook 901T	IBM ThinkPad 570	NEC Versa SX	Sony VAIO PCG-Z505SX	Toshiba Portege 7020CT	Acer TravelMate 721TX	ACT Brilliante NI 7134	ARMNote TS3100	Compaq Prosignia 150	Dell Latitude CPi C400GT
	$3,000 street	$3,100 street	$4,000 street	$3,000 street	$3,400 street	$2,300 street	$1,828 direct	$1,999 direct	$2,350 street	$2,097 direct
	4.1/5.0	4.0/4.7	5.3/6.2	3.5/4.0	4.1/4.8	7.9/8.8	7.0/7.8	7.4/8.2	7.0/8.8	6.5/7.5
	1.8 x 11.5 x 8.8	1.3 x 11.8 x 9.4	1.5 x 9.3 x 12.0	1.0 x 10.7 x 9.0	1.3 x 11.8 x 9.5	2.0 x 12.0 x 10.0	2.0 x 12.5 x 10.0	1.8 x 12.5 x 10.0	2.0 x 12.0 x 10.0	1.8 x 12.0 x 10.0
	Mobile Pentium II/366	Mobile Pentium II/333	Mobile Pentium II/400	Mobile Pentium II/366	Mobile Pentium II/366	Mobile Pentium II/333	Celeron/400	Celeron/433	AMD K6-2/400	Celeron/400
	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	ALI Aladin 5	Intel 440BX
	64MB / 160MB	64MB / 192MB	64MB / 256MB	64MB / 192MB	64MB / 192MB	64MB / 256MB	64MB / 160MB	64MB / 256MB	64MB / 192MB	128MB / 384MB
	256K	256K	256K	256K	256K	256K	128K	128K	1MB	128K
	NeoMagic MagicMedia 256AV	NeoMagic MagicMedia 256AV	Trident Cyber 9388	NeoMagic MagicMedia 256AV	NeoMagic MagicMedia 256AV	NeoMagic MagicGraph 256AV	ATI Rage LT Pro	ATI Rage LT Pro	ATI Rage LT Pro	NeoMagic MagicMedia 256ZX
	2.5MB SGRAM	2.5MB SGRAM	2MB SGRAM	2.5MB SGRAM	2.5MB SGRAM	2.5MB SDRAM	4MB SGRAM	4MB SGRAM	8MB SDRAM	4MB SDRAM
	IBM DBCA-206480	IBM DBCA-204860	Hitachi DK239A-65	Hitachi DK239A-65	Toshiba MK-6411MAT	IBM DADA-26480	Toshiba MK-6409MAV	IBM DBCA-206480	IBM DCXA-210000	Fujitsu MHE2064AT
	6.1GB ATA-4	4.1GB ATA-4	6.1GB ATA-4	6.1GB ATA-4	6.2GB ATA-4	6.1GB ATA-4	6.1GB ATA-4	6.1GB ATA-4	9.5GB ATA-4	6.1GB ATA-4
	External	Swappable	Swappable	External	Swappable	Internal	Internal	Internal	Swappable	Swappable
	SuperDisk	SuperDisk	SuperDisk	None	None	SuperDisk	None	None	None	SuperDisk
	24X	24X	24X	N/A	N/A	20X	24X	24X	24X	24X
	$360 street	$340 street	$150 street	N/A	N/A	$450 street	Included	$149 direct	Included	$299 direct
	■□	■□	■■	■■	■■	■■	■□	■■	■■	■■
	■□	■□	■□	□□	□□	■■	■■	■□	□□	■■
	■■	■■	■■	■■	■■	□□	■■	■■	■■	■□
	□□	□□	□□	□□	□□	□□	□□	□□	□□	□□
	■□	■□	■□	■■	■□	■■	■□	■□	□□	■□
	■	□	■	□	□	■	■	■	■	■
	1/0	1/0	1/0	1/0	1/0	1/0	1/0	2/0	1/0	1/0
	$180 street	$160 street	$160 street	Included	$140 street	N/A	$268 direct	$129 direct	$150 street	$399 direct
	$700 street	$400 street	$800 street	N/A	$650 street	$350 street	N/A	N/A	N/A	$699 direct
	PC Card 56K	Integrated 56K	PC Card 56K	Integrated 56K	Integrated 56K	Integrated 56K	PC Card 56K	PC Card 56K	Integrated 56K	PC Card 56K
	Type III	Type III	Type III	Type III	Type III	Type III	Type III	Type III	Type III	Type III
	■■	■■	■■	■□	■■	■■	■■	■■	■■	■■
	12.3" TFT	13.1" TFT	14.1" TFT	12.1" TFT	13.3" TFT	14.0" TFT	13.2" TFT	13.0" TFT	14.3" TFT	14.1" TFT
	800 x 600	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768
	Lithium ion	Lithium ion	Lithium ion	Lithium ion	Lithium ion	Lithium ion	Lithium ion	Nickel hydride	Lithium ion	Lithium ion
	□	□	□	■	■	□	□	□	□	□
	1 year/1 year	3 years/3 years	3 years/3 years	1 year/1 year	3 years/1 year	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year
	$179.00	$49.00	Included	N/A	$79.00	N/A	N/A	N/A	Included	Included
	■	■	■	■	■	■	□	□	■	■
	■	□	■	□	■	□	□	■	■	■

Graphics WinMark 99; and overall performance, as measured by the Business Winstone 99 score, was average as well.

Gateway's one-year parts-and-labor warranty is standard and includes 24-hour, 7-day technical support. On-site service for the one-year warranty period is $79. (Gateway, North Sioux City, SD; 800-428-3929; *www.gateway.com.*)

The $1,600 **HP OmniBook XE2** is a 333-MHz Mobile Celeron–based configuration with design perks like translucent blue buttons and a contoured shell. Weighing 6.5 pounds and capable of midrange performance, the OmniBook machine is backed by HP's strong service and support and is clearly worth a close look.

The XE2's lithium ion battery proved average on our BatteryMark test, lasting for 3:11. As with other notebooks that shipped with 32MB of memory versus 64MB, the unit posted slightly below average Business Winstone 99 score. Its graphics subsystem did well on Business Graphics WinMark, but it does not provide 3-D acceleration.

We did have a few nits: The XE2's 12.1-inch TFT display is bright and legible, but brightness controls seem to have scant effect. The Flexmark keyboard is well laid out, but it does bounce a bit. Lastly, the system supports 3-D audio, but the built-in speakers were not particularly loud, and audio quality was a notch below that of the IBM iSeries. But you can use those translucent blue buttons to play CDs while the system is turned off.

HP's documentation is complete and well managed, and the Web site provides a wealth of support information. The company provides a standard one-year warranty on parts and labor; a full three-year warranty costs an additional $179. (Hewlett-Packard Co., Santa Clara, CA;

SUMMARY OF FEATURES

Notebook PCs

MAINSTREAM DESKTOP REPLACEMENT ■ YES □ NO	FutureTech FutureMate FM31XL	Gateway Solo 2500 LS	HP OmniBook XE2	IBM ThinkPad 390E	Micron TransPort TREK 2	PC Notebook Cheetah IIc Pro	Toshiba Satellite 4030CDT	WinBook XL2 C400
Price of tested configuration	$2,029 direct	$2,199 direct	$2,200 street	$2,300 street	$2,099 direct	$1,999 direct	$1,800 street	$2,137 direct
System weight/Travel weight* (pounds)	7.2 / 8.0	7.2 / 8.1	7.0 / 7.8	7.5 / 8.3	7.9 / 8.7	7.3 / 8.1	6.7 / 7.5	7.4 / 8.3
Dimensions (HWD, in inches)	2.0 x 13.5 x 10.0	2.0 x 11.6 x 9.3	1.8 x 12.3 x 10.0	1.9 x 12.4 x 10.0	2.0 x 12.3 x 10.0	1.5 x 12.2 x 10.0	2.0 x 12.5 x 10.0	1.5 x 12.2 x 9.6
Processor	Celeron/433	Mobile Pentium II/333	Mobile Pentium II/333	Mobile Pentium II/300	Mobile Celeron/400	Celeron/466	Mobile Celeron/333	Mobile Celeron/400
Chip set	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX
Installed/maximum system RAM	64MB / 256MB	64MB / 256MB	64MB / 256MB	32MB / 256MB	64MB / 256MB	64MB / 256MB	64MB / 192MB	64MB / 256MB
Installed pipelined-burst cache	128K	256K	256K	256K	128K	128K	128K	128K
Graphics chip set	ATI Rage LT Pro	NeoMagic MagicGraph 128XD	Silicon Motion SM810 LynxE	NeoMagic MagicMedia 256AV	ATI Rage LT Pro	ATI Rage LT Pro	Trident Cyber 9525	ATI Rage LT Pro
Graphics memory	4MB SGRAM	2MB SGRAM	2MB SGRAM	2.5MB SGRAM	8MB SDRAM	4MB SDRAM	2.5MB SGRAM	4MB SDRAM
Hard disk	Toshiba MK-6409MAV	Toshiba MK-6411MAT	IBM DADA-26480	IBM DKLA-23240	IBM DKLA-24320	IBM DADA-26480	Toshiba MK-4310MAT	Hitachi DK228A-65
Capacity and interface	6.1GB ATA-4	6.1GB ATA-4	6.1GB ATA-4	3.1GB ATA-4	4.1GB ATA-4	6.1GB ATA-4	4.1GB ATA-4	6GB ATA-4
Floppy disk drive	Internal	Internal	Internal	Swappable	Swappable	Internal	Internal	Internal
Floppy disk option	SuperDisk	SuperDisk	None	SuperDisk	SuperDisk	SuperDisk	None	None
CD-ROM maximum speed	24X	24X	24X	24X	24X	24X	24X	24X
Price of DVD-ROM drive	Included	$150 direct	N/A	$390 street	$199 direct	$199 direct	N/A	Included
Built-in speakers/microphone	■■	■■	■■	■■	■■	■■	■□	■■
Line-in/line-out jack	■■	■□	■□	■□	■■	■□	■□	■■
Microphone/speaker jack	■■	■■	□■	■■	■■	■■	■■	■■
NTSC video-in/video-out	□■	□■	□□	□□	□□	□■	□□	□■
Infrared port/Ethernet Port	■□	■□	■□	■□	■□	□□	■□	■□
Shared mouse/keyboard port	■	■	■	□	■	■	■	■
USB ports/IEEE 1394 ports	2 / 0	2 / 0	1 / 0	1 / 0	2 / 0	2 / 0	1 / 0	1 / 0
Price of port replicator	$145 direct	$100 direct	$130 street	$160 street	$149 direct	$179 direct	$200 street	$99 direct
Price of full docking station	N/A	$599 direct	N/A	$400 street	N/A	N/A	N/A	N/A
Modem	PC Card 56K	PC Card 56K	Integrated 56K	Integrated 56K	PC Card 56K	PC Card 56K	Integrated 56K	Integrated 56K
PC Card slot	Type III	Type III	Type III	Type III	Type III	Type III	Type III	Type II
CardBus/Zoomed video support	■■	■■	■■	■■	■■	■■	■□	■■
LCD-panel size and type	14.1" TFT	13.1" TFT	13.3" TFT	13.1" TFT	14.1" TFT	14.1" TFT	13.5" TFT	14.1" TFT
Screen resolution	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768
Battery type	Lithium ion	Lithium ion	Lithium ion	Nickel hydride	Lithium ion	Lithium ion	Nickel hydride	Lithium ion
ACPI operational	□	□	□	□	□	□	■	■
Standard warranty on parts/labor	1 year/1 year	1 year/1 year	1 year/1 year	1 year/1 year	3 years/3 years	1 year/1 year	1 year/1 year	1 year/1 year
On-site service charge for first year	N/A	$79.00	$179.00	$49.00	$149.00	$99.00	$79.00	N/A
24-hour, 7-day technical support	□	■	■	■	■	□	■	□
24-hour turnaround for parts	■	■	■	□	■	■	■	□

* System weight is the PC plus battery, with drive bays filled. Travel weight adds the AC adaptor. N/A—Not applicable. The product does not have this feature.

800-637-7740; *www.hp.com.*)

The **IBM ThinkPad iSeries 1412** ($1,700 street), targeted at home users and individual buyers, is not as sleek or sexy as its higher-priced, corporate-oriented IBM siblings. But the 366-MHz Mobile Celeron–based system stands out in this crowd of value machines: By a wide margin, the iSeries 1412 has the best keyboard and ergonomics, and its performance ranked among the top.

In contrast with the bouncy, oddly laid-out keyboards from other systems in this group, the iSeries keyboard is a pleasure to use, providing good—but not stiff—resistance and a solid feel. The unit's 12.1-inch TFT screen is bright and crisp, and the internal Altec Lansing speakers yield the best audio in the category.

The NEC Versa Note is our pick for a value portable.

Top-quality components, including a fast IBM 4.5GB hard disk and NeoMagic MagicMedia 256AV graphics accelerator, powered the iSeries 1412 to an impressive ranking on our performance tests. On our Business Winstone 99 tests, the iSeries 1412 ranked first among units with 32MB of memory, and its Business Graphics WinMark and Disk WinMark results were also top-notch. And you'll like taking it on the

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Continues

	Apple PowerBook G3	Brick Ergo BigScreen[5]	Compaq Armada 7800	Dell Inspiron 7000 A400LT	Fosa AP 2100P	Gateway Solo 9150	HP OmniBook 4150	IBM ThinkPad 600E	MAG Verity 8536CDT	Micro Express MP6366V
				PC MAGAZINE EDITORS' CHOICE				PC MAGAZINE EDITORS' CHOICE		
	$3,500 street	$3,895 direct	$4,500 street	$3,582 direct	$2,485 direct	$4,049 direct	$3,800 street	$4,100 street	$3,000 street	$2,000 direct
	6.4 / 7.1	8.7 / 9.5	8.9 / 9.1	9.4 / 10.4	7.7 / 8.5	8.7 / 9.5	6.4 / 7.3	5.6 / 6.4	9.2 / 10.0	8.4 / 9.2
	1.8 x 12.5 x 10.5	2.3 x 12.7 x 12.5	2.0 x 12.5 x 9.5	2.1 x 12.8 x 10.5	2.0 x 12.3 x 10.0	2.3 x 12.5 x 10.2	1.8 x 12.5 x 10.0	1.5 x 11.8 x 9.5	2.0 x 13.0 x 10.3	2.0 x 12.4 x 9.8
	PowerPC G3/400	Mobile Pentium II/366	Mobile Pentium II/400	Mobile Pentium II/400	Mobile Pentium II/333	Mobile Pentium II/400	Mobile Pentium II/400	Mobile Pentium II/400	Mobile Pentium II/366	Mobile Pentium II/366
	IBM/Motorola G3	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX
	64MB / 384MB	128MB / 384MB	128MB / 256MB	128MB / 384MB	128MB / 384MB	128MB / 384MB	128MB / 256MB	128MB / 288MB	128MB / 384MB	128MB / 256MB
	1MB	256K	256K	256K	256K	256K	256K	256K	256K	256K
	ATI Rage LT Pro	ATI Rage LT Pro	S3 ViRGE MX	ATI Rage LT Pro	ATI Rage LT Pro	ATI Rage LT Pro	NeoMagic MagicMedia 256AV	NeoMagic MagicMedia 256AV	ATI Rage LT Pro	ATI Rage LT Pro
	8MB SDRAM	8MB SDRAM	4MB SDRAM	8MB SDRAM	8MB SGRAM	8MB SGRAM	2.5MB SGRAM	2.5MB SGRAM	8MB SGRAM	8MB SDRAM
	IBM DADA-26480	IBM DCYA-2140000	IBM DCYA-2140000	IBM DCYA-2140000	Toshiba MK-1011GAV	IBM DCYA-2140000	IBM DCXA-210000	IBM DCXA-210000	Toshiba MK-6409MAV	Toshiba MK-6409MAV
	6.1GB ATA-4	13.4GB ATA-4	13.4GB ATA-4	13.4GB ATA-4	9.5GB ATA-4	13.4GB ATA-4	9.5GB ATA-4	9.5GB ATA-4	6.1GB ATA-4	6.1GB ATA-4
	None	Internal	Swappable	Swappable	Swappable	Swappable	Swappable	Swappable	Internal	Internal
	SuperDisk	SuperDisk, Zip	SuperDisk	Zip	SuperDisk	SuperDisk, Zip	SuperDisk	SuperDisk, Zip	Zip	SuperDisk
	24X	20X	24X	24X	24X	24X	24X	24X	20X	20X
	Included	$150 direct	$420 street	Included	Included	Included	Included	Included	Included	Included
	■■	■■	■■	■■	■■	■■	■■	■■	■■	■■
	■■	■□	□■	■□	■■	■■	■■	□□	■■	■■
	■■	■■	■■	■■	■□	■■	■□	■■	■■	■■
	□□	■■	□□	□■	■■	■■	□□	■■	□■	■■
	■■	■□	□□	■□	□□	□□	■□	■□	■□	■□
	□	■	■	■	■	■	■	□	■	■
	2 / 0	1 / 0	1 / 0	1 / 0	2 / 0	2 / 0	1 / 0	1 / 0	1 / 0	2 / 0
	N/A	$195 direct	$440 street	$149 direct	$140 direct	$100 direct	$180 street	$190 street	$180 street	N/A
	N/A	$595 direct	$780 street	N/A	N/A	$599 direct	$700 street	$700 street	N/A	$249 direct
	PC Card 56K	PC Card 56K	Integrated 56K	Integrated 56K	PC Card 56K	Integrated 56K	PC Card 56K	Integrated 56K	Integrated 56K	PC Card 56K
	Type III	Type III	Two type II	Type III	Type III	Type III	Type III	Type III	Type III	Type III
	■■	■■	■■	■■	■■	■■	■■	■■	■■	■■
	14.1" TFT	15.0" TFT	13.1" TFT	15.3" TFT	14.0" TFT	15.3" TFT	14.0" TFT	13.1" TFT	15.0" TFT	14.1" TFT
	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768
	Lithium ion	Lithium ion	Lithium ion	Lithium ion	Lithium ion	Lithium ion	Lithium ion	Lithium ion	Lithium ion	Lithium ion
	■	□	□	□	□	□	□	□	■	□
	1 year/1 year	4 years/4 years	3 years/3 years	3 years/3 years	1 year/1 year	1 year/1 year	3 years/3 years	3 years/3 years	1 year/1 year	4 years/4 years
	N/A	N/A	$199.00 (3 years)	N/A	N/A	$79.00	$189.00	$49.00	N/A	N/A
	□	□	■	□	□	■	■	■	□	■
	□	□	■	□	■	■	□	□	□	■

road: Its BatteryMark score was 4:08, and the unit weighs just 7.1 pounds.

IBM provides a members-only Web site with technical support and upgrade advice as well as a one-year parts-and-labor warranty. Optional service packs cover a wide range of user needs. (IBM Corp., Armonk, NY; 800-426-7255; *www.ibm.com.*)

The **NEC Versa Note** ($1,600 street)—based on a 300-MHz Mobile Celeron processor and 64MB of SDRAM—provided excellent all-around performance, and the company's UltraCare service is among the industry's best. For those looking for a lightweight three-spindle notebook with good value, the Versa Note is our Editors' Choice.

Thinner and lighter than most others in this category, the Versa Note's flexible keyboard is nicely spaced and less bouncy than most. The 12.1-inch TFT display is bright and clear. The Versa Note effectively tied with the ChemBook 7200 for best all-around performance in the value category, and its Business Winstone 99 test score showed the benefit of having 64MB of SDRAM versus the 32MB standard among value notebooks. (Note that both top-scoring units have slower processors but more memory than the other machines in this class.) The Versa Note's NeoMagic MagicGraph 128XD graphics accelerator was average, but its 4GB hard disk was above average on our Disk WinMark 99 tests. Its BatteryMark score was average, at 2:26.

NEC's standard warranty covers three years on parts and labor. Registered users are entitled to one year of UltraCare Preferred service, which provides for on-site service and prepaid courier delivery—a rarity among value lines. That extra touch puts the Versa Note over the top, in our estimation. (NEC Computer Systems

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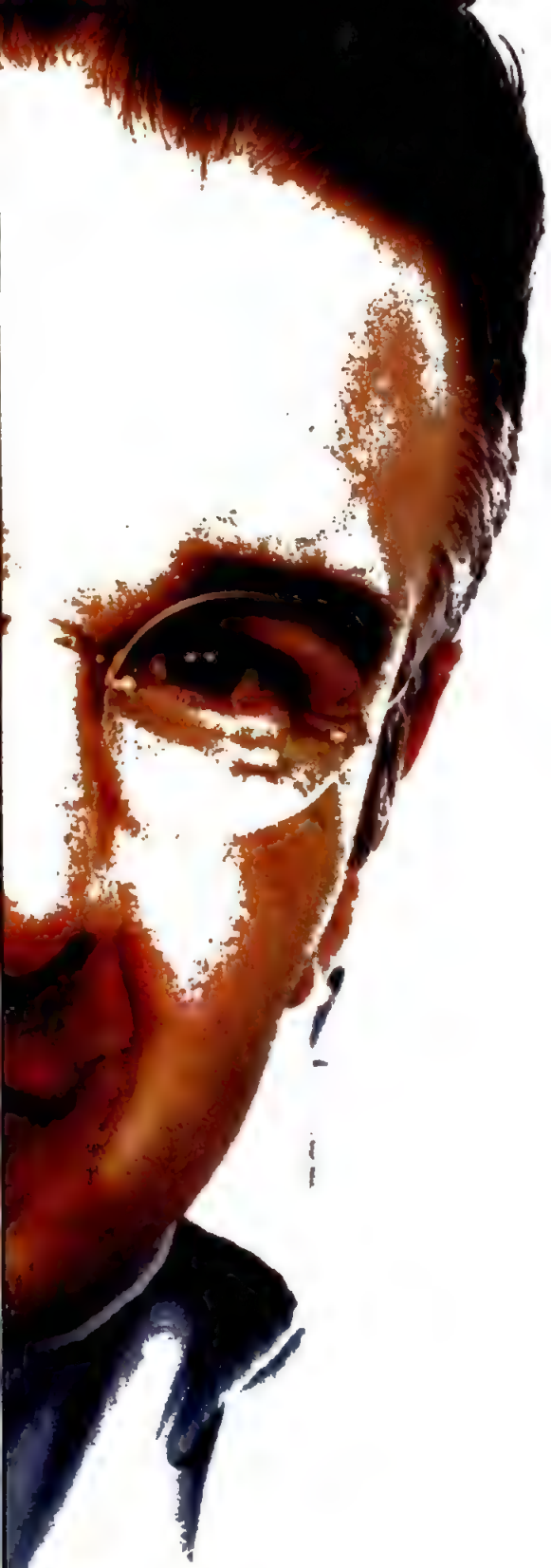

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SUMMARY OF FEATURES

Notebook PCs

DESKTOP REPLACEMENT VALUE ■ YES □ NO	Micron TransPort NX	MidWest Micro Solis	NEC Versa LX	Panasonic Toughbook 71	Quantex I-1410	Sceptre Tech SoundX 6500	Sony VAIO PCG-F190	Toshiba Tecra 8000
Price of tested configuration	$3,499 direct	$3,199 direct	$4,600 street	$3,599 direct	$2,927 direct	$2,399 direct	$3,100 street	$4,360 street
System weight/Travel weight* (pounds)	8.8 / 9.6	9.2 / 10.7	7.7 / 8.6	7.2 / 8.1	8.9 / 9.6	8.7 / 9.6	7.1 / 7.9	6.6 / 7.4
Dimensions (HWD, in inches)	2.3 x 12.8 x 10.5	2.0 x 12.8 x 9.8	1.8 x 12.0 x 10.0	1.8 x 11.8 x 10.5	1.6 x 12.6 x 10.2	2.5 x 12.6 x 10.0	1.6 x 12.6 x 10.2	1.5 x 12.0 x 10.0
Processor	Mobile Pentium II/366	Mobile Pentium II/400	Mobile Pentium II/400	Mobile Pentium II/366	Mobile Pentium II/400	Mobile Pentium II/366	Mobile Pentium II/366	Mobile Pentium II/366
Chip set	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX
Installed/maximum system RAM	128MB / 384MB	128MB / 384MB	128MB / 256MB	128MB / 192MB	128MB / 384MB	128MB / 384MB	128MB / 192MB	128MB / 256MB
Installed pipelined-burst cache	256K	256K	256K	256K	256K	256K	256K	256K
Graphics chip set	ATI Rage LT Pro	ATI Rage LT Pro	ATI Rage LT Pro	NeoMagic MagicMedia 256AV	ATI Rage LT Pro	ATI Rage LT Pro	NeoMagic MagicMedia 256AV	NeoMagic MagicMedia 256AV
Graphics memory	8MB SDRAM	8MB SDRAM	8MB SDRAM	2.5MB SDRAM	8MB SDRAM	8MB SGRAM	2MB SDRAM	2.5MB SDRAM
Hard disk	IBM DCYA-2140000	Hitachi DK299A-10	IBM DCXA-210000	Fujitsu MHG2102AT	IBM DYLA-28100	IBM DLYA-26480	IBM DBCA-206480	IBM DYLA-28100
Capacity and interface	13.4GB ATA-4	9.6GB ATA-4	9.5GB ATA-4	9.5GB ATA-4	7.8GB ATA-4	6.1GB ATA-4	6.1GB ATA-4	7.8GB ATA-4
Floppy disk drive	Swappable	Internal	Internal	Swappable	Internal	Internal	Swappable	Internal
Floppy disk option	SuperDisk, Zip	SuperDisk	SuperDisk	SuperDisk	None	SuperDisk, Zip	None	SuperDisk, Zip
CD-ROM maximum speed	20X	24X	24X	24X	24X	24X	20X	24X
Price of DVD-ROM drive	Included	Included	Included	$449 direct	Included	Included	Included	Included
Built-in speakers/microphone	■ ■	■ ■	■ ■	■ ■	■ ■	■ □	■ ■	■ ■
Line-in/line-out jack	■ □	■ □	■ □	■ ■	■ □	■ □	□ □	■ ■
Microphone/speaker jack	■ ■	■ ■	■ ■	■ ■	■ ■	□ ■	■ ■	□ ■
NTSC video-in/video-out	■ ■	□ ■	□ ■	□ □	□ □	□ □	□ □	■ ■
Infrared port/Ethernet port	■ □	■ □	■ □	□ □	■ □	■ □	■ □	■ □
Shared mouse/keyboard port	■	■	■	■	■	■	■	■
USB ports/IEEE 1394 ports	1 / 0	1 / 0	1 / 0	1 / 0	1 / 1	1 / 0	1 / 1	1 / 0
Price of port replicator	$149 direct	$199 direct	$160 street	$399 direct	$149 direct	$200 direct	$200 street	$600 street
Price of full docking station	N/A	N/A	$800 street	N/A	N/A	N/A	N/A	$950 street
Modem	PC Card 56K	Internal 56K	PC Card 56K	PC Card 56K	Integrated 56K	PC Card 56K	Integrated 56K	PC Card 56K
PC Card slot	Type III	Type III	Type III	Type III	Type III	Type III	Type III	Type III
CardBus/Zoomed video support	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■	■ □	■ □
LCD-panel size and type	15.0" TFT	15.0" TFT	14.0" TFT	13.3" TFT	14.0" TFT	14.0" TFT	14.0" TFT	14.0" TFT
Screen resolution	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768	1,024 x 768
Battery type	Lithium ion	Lithium ion	Lithium ion	Lithium ion	Lithium ion	Lithium ion	Lithium ion	Lithium ion
ACPI operational	□	□	□	□	□	□	■	■
Standard warranty on parts/labor	3 years/3 years	1 year/1 year	3 years/3 years	3 years/3 years	3 years/1 year	1 year/1 year	1 year/1 year	3 years/1 year
On-site service charge for first year	$149.00	N/A	Included	Varies	N/A	N/A	N/A	$79.00
24-hour, 7-day technical support	■	■	■	■	■	□	■	■
24-hour turnaround for parts	■	■	■	■	□	□	□	■

* System weight is the PC plus battery, with drive bays filled. Travel weight adds the AC adaptor. N/A—Not applicable: The product does not have this feature.

Division, Boxborough, MA; 888-863-2669; *www.nec-computers.com.*)

The **Sony VAIO PCG-F150** ($1,700 street), based on a 300-MHz Pentium II, is being phased out in favor of the recently announced PCG-F250. But the PCG-F150 should still be available—likely at steep discounts—in retail channels this summer. The newer F200 series will address the PCG-F150's weakest point: a washed-out dual scan screen that, but for the nearly unusable Toshiba Satellite 2535CDS's display, would have been the worst in the review. Bottom line: Wait for the PCG-F250.

Performance was generally poor: The PCG-F150 finished dead last among all notebooks in this roundup on our Business Winstone 99 tests and did little better on the other benchmark tests. In particular, the system managed a category-low score of 2:12 on our BatteryMark test.

The PCG-150F is large but fairly thin (1.4 inches). The built-in V.90 modem doubles as a speakerphone, and the PCG-F150's IEEE 1394 port is a welcome touch. Sony provides a one-year warranty on parts and labor, though on-site service is not available. (Sony Electronics Inc., San Jose, CA; 408-943-0740; *www.sony.com.*)

The **Toshiba Satellite 2535CDS** ($1,300 street), based on an out-of-date 300-MHz Mobile Pentium MMX CPU, has an incredibly bad dual-scan screen—so bad that you need to enable mouse trails to find the rapidly disappearing cursor. Given the breadth and depth of Toshiba's notebook offerings, we have difficulty recommending this unit. In fact, you'd be better off spending more money on a Satellite 2445 and its optional TFT display (not available for the 2535CDS).

The Satellite 2535CDS's performance was among the lowest in the roundup. One bright spot was its lithium ion bat-

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Ends

PC MAGAZINE EDITORS' CHOICE

WinBook XL² PII 400	AMS Roadster 21CT366	ChemBook 7200	Gateway Solo 2500 SE	HP OmniBook XE2	IBM ThinkPad iSeries 1412	NEC Versa Note	Sony VAIO PCG-F150	Toshiba Satellite 2535CDS	WinBook XL
$3,399 direct	$1,800 street	$1,499 direct	$1,549 direct	$1,600 street	$1,700 street	$1,600 street	$1,700 street	$1,300 street	$1,599 direct
7.5 / 8.4	7.1 / 7.7	6.2 / 7.0	6.9 / 7.8	6.5 / 7.3	7.1 / 7.9	6.4 / 7.2	7.2 / 7.9	6.7 / 7.5	7.5 / 8.4
1.5 x 12.2 x 9.6	2.0 x 11.8 x 9.3	1.5 x 11.5 x 9.2	2.0 x 11.5 x 9.2	1.8 x 12.3 x 10.0	1.8 x 13.0 x 10.0	1.5 x 11.8 x 9.8	1.4 x 12.6 x 10.1	2.0 x 12.2 x 10.2	2.0 x 11.8 x 9.6
Mobile Pentium II/400	Celeron/366	Celeron/300	Mobile Celeron/333	Mobile Celeron/333	Mobile Celeron/366	Mobile Celeron/300	Mobile Pentium II/300	Mobile Pentium MMX/300	AMD K6-2/400
Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Intel 440BX	Symphony3	Intel 430TX
128MB / 256MB	32MB / 160MB	64MB / 160MB	32MB / 256MB	32MB / 256MB	32MB / 256MB	64MB / 128MB	32MB / 160MB	64MB / 160MB	128MB / 256MB
256K	128K	128K	128K	128K	128K	128K	256K	512K	256K
ATI Rage LT Pro	ATI Rage LT Pro	Silicon Motion Lynx SMI 910	NeoMagic MagicGraph 128XD	Silicon Motion SM810 LynxE	NeoMagic MagicMedia 256AV	NeoMagic MagicGraph 128XD	NeoMagic MagicMedia 256AV	Chips and Technologies F69000	Chips and Technologies 65554PCI
4MB SGRAM	4MB SGRAM	2MB SDRAM	2MB SGRAM	2MB SGRAM	2.5MB SGRAM	2MB SGRAM	2MB SDRAM	2MB SDRAM	2MB SDRAM
Hitachi DK229A-10	Toshiba MK-4309MAT	IBM DADA-24680	Hitachi DK238A-43	IBM DKLA-24320	IBM DADA-24880	Hitachi DK238A-43	Fujitsu MHF2043AT	Toshiba MK-4310MAT	Hitachi DK237A-32
9.6GB ATA-4	4.1GB ATA-4	4.5GB ATA-4	4.1GB ATA-4	4.1GB ATA-4	4.5GB ATA-4	4.1GB ATA-4	4.1GB ATA-3	4.1GB ATA-3	3.1GB ATA-3
Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal	Internal
SuperDisk	None	None	SuperDisk	None	None	None	None	None	None
24X	30X	24X	24X	24X	24X	24X	24X	24X	24X
Included	N/A	$150 direct	$150 direct	N/A	N/A	N/A	N/A	N/A	N/A
■■	■■	■■	■■	■■	■■	■■	■■	■■	■■
■■	■□	■■	■□	■□	■□	■□	□□	□■	■□
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1 / 0	1 / 0	1 / 0	2 / 0	1 / 0	1 / 0	1 / 0	1 / 1	1 / 0	2 / 0
$99 direct	N/A	$150 direct	$100 direct	$130 street	$120 street	$160 street	$200 street	N/A	$99 direct
N/A	N/A	N/A	$599 direct	N/A	N/A	N/A	N/A	N/A	N/A
PC Card 56K	Integrated 56K	Integrated 56K	PC Card 56K	Integrated 56K	Integrated 56K	Integrated 56K	Integrated 56K	PC Card 56K	PC Card 56K
Type III	Type III	Type III	Type III	Type III	Type III	Type III	Type III	Type III	Type III
■■	■■	■■	■■	■■	□□	■■	■■	■□	■■
14.1" TFT	12.0" TFT	12.1" TFT	12.1" TFT	12.1" TFT	12.1" TFT	12.1" TFT	13.0 DSTN	13.0 DSTN	12.1" TFT
1,024 x 768	800 x 600	800 x 600	800 x 600	800 x 600	800 x 600	800 x 600	1,024 x 768	1,024 x 768	800 x 600
Lithium ion	Nickel hydride	Lithium ion	Lithium ion	Lithium ion	Lithium ion	Nickel hydride	Lithium ion	Lithium ion	Nickel hydride
■	□	□	□	□	□	□	■	■	□
1 year/1 year	3 years/3 years	1 year/3 years	1 year/1 year	1 year/1 year	1 year/1 year	3 years/3 years	1 year/1 year	1 year/1 year	1 year/1 year
N/A	N/A	N/A	$79.00	$179.00	$49.00	Included	N/A	$79.00	N/A
□	□	■	■	■	■	■	■	■	□
□	□	□	■	■	□	■	□	■	□

tery, which ran for 4:10 on our BatteryMark 99 test. The Satellite's speakers are loud but muddy, though they offer decent bass and treble controls. The keyboard is roomy and well laid out.

Toshiba's standard warranty provides for one-year parts-and-labor coverage and 24-hour, 7-day remote support. The company has many option plans, including warranty extensions, next day on-site service, and screen protection insurance. (Toshiba America Inc., New York; 800-959-4100; *www.toshiba.com.*)

The **WinBook XL** ($1,599 direct) comes equipped with a 400-MHz AMD K6-2 processor and a healthy 128MB of memory. The 7.5-pound machine achieved commendable overall performance, but its graphics accelerator is a bit anemic. Graphics performance notwithstanding, the XL provides good value.

The unit's Flexmark keyboard did not lie flat—it was unintentionally concave along the top two rows—and it bounced up and down when we typed on it. The 12.1-inch TFT screen is bright and crisp, but brightness and contrast controls have little effect.

The unit's AMD processor scored a mere 13.2 on CPUmark 99, but the number appears to be an anomaly; overall performance as measured on our Business Winstone 99 tests was quite respectable. The Chips and Technologies graphics accelerator does not support 3-D, and its 2-D performance was poor. The XL's 3GB hard disk, one of the smallest we reviewed, scored well on our Disk WinMark 99 tests. The battery score, however, was disappointing: just 1:20 on our BatteryMark 99 test. The unit comes with a one-year warranty, but there is no 24-hour toll-free tech support or on-site service. (WinBook Computer Corp., Columbus, OH; 800-295-1641; *www.winbook.com.*) PC

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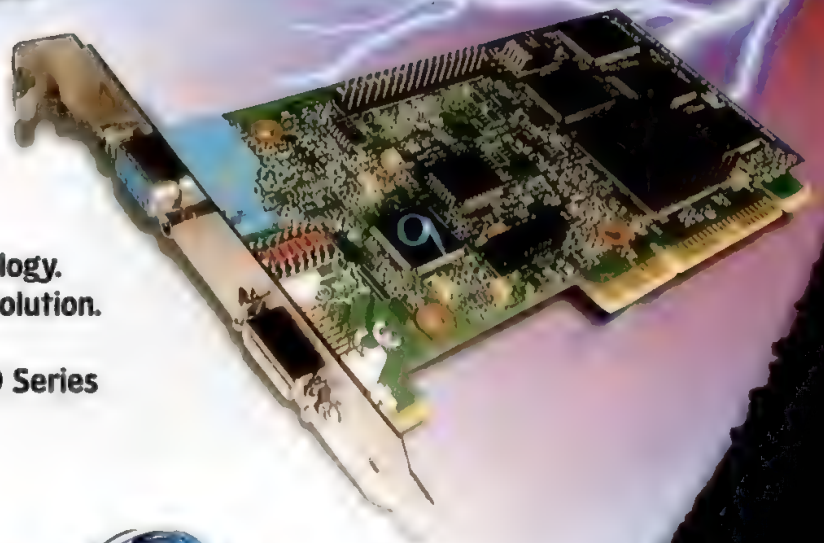

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THE Road Warriors' GUIDE

PC MAGAZINE

Whether you travel a lot or a little, this pullout supplement contains all the information you're likely to need on the road, from our favorite Web sites for travelers to important phone numbers and tips for getting connected. Tear it out and slip it into your laptop case.

EDITORS' HOT LINKS
top Web sites for travelers

GENERAL-INTEREST AND NEWS SITES

www.cnn.com News, sports, business, weather, and more from CNN.
www.msnbc.com News, sports, business, weather, and more from MSNBC.
www.nytimes.com The daily content of The New York Times, plus high-tech news in CyberTimes.
www.pcmag.com PC Magazine Online. First Looks product reviews, daily reports on high-tech trends, opinions, and more.
travel.state.gov World travel warnings and advisories from the U.S. Department of State.
www.wsj.com News, stocks, and company profiles from The Wall Street Journal.
www.weather.com The Weather Channel.

ONLINE RESERVATIONS

www.biztravel.com BizTravel. Maximize awards when you book flight, car, and hotel reservations.
www.expedia.msn.com Our choice for family travel; includes airline, hotel, and rental-car reservations, vacation packages, special deals, and more.
www.travelocity.com Airline and hotel reservations, listings of local attractions, and late-breaking discounts.
www.trip.com Air travel reservations, flight status information, airport maps, hotel listings and reviews, and city guides.

SPECIALIZED SITES

www.citysearch.com Details about daily life in roughly two dozen U.S. cities and several international destinations.
www.franzus.com/services.htm A voltage guide by country, and tips to keep your appliances from burning out overseas.
www.krollassociates.com/KTS Kroll Travel Watch. Worldwide travel advisories as well as information on what parts of town to avoid and what to wear. For $19.95, Kroll will fax you a full city advisory.
www.mapquest.com A map store plus online directions and a moving expense calculator.
www.rubicon.com/passport.html Rubicon Digital Passport. Interactive currency converter; listings of airports, airlines, embassies, and international holidays.
www.supporthelp.com Technical-support numbers, Web sites, and newsgroups for over 2,500 computer product vendors.
www.travelersaid.org Travelers Aid International. Aid information and contacts for U.S. and foreign cities.
www.travelstuff.com/plglist.html Travelers Emporium. An online list of international electric/telephone plug and power standards.
www.zagat.com Zagat Survey. Top restaurants in major American cities.

OVERNIGHT DELIVERY SERVICE LOCATORS

www2.airborne.com/dropbox locator/default.asp Airborne Express.
www.fedex.com/us/dropoff Federal Express.
www.ups.com/using/services/locate/locate.html UPS.
www.usps.gov U.S. Postal Service.
www.ishipcom Compare the rates of the shippers above.

TELEPHONE DIRECTORIES

www.infospace.com White Pages, Yellow Pages, government listings, classifieds, e-shopping, and much more.
people.yahoo.com Yahoo! People Search. The site also offers Yellow Pages listings.
www.switchboard.com Switchboard lets you find a person or a business by name or by proximity to a location.
www.teldir.com A directory of Web telephone directories covering the entire world.

PORTALS AND SEARCH SITES

www.about.com
www.excite.com
www.go.com
www.google.com
www.msn.com
www.northernlight.com
www.profusion.com
www.yahoo.com

Personal Information

Phone number: e-mail system _____

Phone number: remote access _____

Phone number: voice mail _____

Phone number: travel agent _____

Notebook serial number _____

CHECK LIST

CRITICAL ITEMS ■ Notebook computer ■ Notebook AC adapter and cables ■ Removable floppy disk drive and CD-ROM drive ■ Modem and connector cable (dongle) ■ RJ-11 phone cord ■ International phone and electrical adapters ■ Business cards ■ Day planner and meeting schedule ■ Cash, traveler's checks, credit cards, local currency ■ Tickets, itinerary, directions ■ Car and hotel confirmation numbers ■ Driver's license, passport, necessary visas

Little Black Book

	PHONE NUMBER	WEB SITE
AUTOMOBILE RENTAL		
Alamo	800-462-5266	www.goalamo.com
Avis	800-331-1212	www.avis.com
Budget	800-527-0700	www.budgetrentacar.com
Dollar	800-800-4000	www.dollarcar.com
Enterprise	800-566-9249	www.pickenterprise.com
Hertz	800-654-3131	www.hertz.com
National	800-227-7368	www.nationalcar.com
Thrifty	800-331-9111	www.thrifty.com
LOST CREDIT CARDS		
American Express	800-554-2639	www.americanexpress.com
Diners Club	800-234-6377	www.dinersclub.com
MasterCard	800-826-2181	www.mastercard.com
Visa	800-336-8472	www.visa.com
LODGINGS		
Best Western	800-528-1234	www.bestwestern.com
Courtyard by Marriott	800-321-2211	www.courtyard.com
Doubletree	800-222-8733	www.doubletreehotels.com
Embassy Suites	800-362-2779	www.embassysuites.com
Fairmont	800-527-4727	www.fairmont.com
Four Seasons	800-332-3442	www.fourseasons.com
Hilton	800-445-8667	www.hilton.com
Holiday Inn	800-465-4329	www.holiday-inn.com
Hyatt	800-233-1234	www.hyatt.com
Inter-Continental	800-327-0200	www.interconti.com
ITT Sheraton	800-325-3535	www.sheraton.com
Marriott	800-228-9290	www.marriott.com
Meridien	800-543-4300	www.lemeridien.com
Omni	800-843-6664	www.omnihotels.com
Quality Inn (Choice)	800-228-5151	www.hotelchoice.com
Radisson	800-333-3333	www.radisson.com
Resinnter Group	800-221-4542	www.hotelweb.fr
Ritz-Carlton	800-241-3333	www.ritzcarlton.com
Westin	800-228-3000	www.westin.com

	PHONE NUMBER	WEB SITE	YOUR ACCOUNT NUMBER
OVERNIGHT DELIVERY SERVICES			
Airborne Express	800-247-2676	www.airborne.com	
DHL	800-225-5345	www.dhl.com	
Federal Express	800-238-5355	www.fedex.com	
UPS	800-742-5877, 800-782-7892*	www.ups.com	

* For international destinations

ACCESSING LONG-DISTANCE CARRIERS (IN THE U.S.)			
AT&T	800-225-5288	www.att.com/traveler	
MCI	800-888-8000	www.mci.com/aboutyou/interests/international/travelguide	
Sprint	800-663-3463	www.sprintbiz.com/products/callingcard	

	DOMESTIC INFORMATION	INTERNATIONAL INFORMATION	WEB SITE
TRAVEL			
Air France	—	800-237-2747	www.airfrance.com
Alitalia	—	800-223-5730	www.alitalia.it
American	800-433-7300	800-433-7300	www.americanair.com
Amtrak	800-872-7245	—	www.amtrak.com
ANA	—	800-235-9262	www.ana.co.jp
British Airways	—	800-247-9297	www.british-airways.com
Continental	800-525-0280	800-231-0856	www.continental.com
Delta	800-221-1212	800-241-4141	www.delta-air.com
JAL	—	800-525-3663	www.jal.co.jp
Lufthansa	—	800-645-3880	www.lufthansa.com
Mexicana	—	800-531-7921	www.mexicana.com
Northwest/KLM	800-225-2525	800-447-4747	www.nwa.com
Qantas	—	800-227-4500	www.qantas.com
SAS	—	800-221-2350	www.flysas.com
Singapore	—	800-742-3333	www.singaporeair.com
Southwest	800-435-9792	—	www.iflyswa.com
Swissair	—	800-221-4750	www.swissair.com
TWA	800-221-2000	800-892-4141	www.twa.com
United	800-241-6522	800-241-6522	www.ual.com
USAirways	800-428-4322	800-622-1015	www.usairways.com
Virgin Atlantic	—	800-862-8621	www.fly.virgin.com

Travel Accessories
where to find those necessities

COMPUTER DISCOUNT WAREHOUSE

CDW—"Computing Solutions Built for Businesses"—offers hardware, software, books, and more as well as CDWdirect, a customizable corporate extranet. 800-[illegible], www.cdw.com

1-800-BATTERIES

Not only batteries but also mobile gear and gadgets. Cell phone products, too. 800-[illegible], www.[illegible].com

TARGUS

Targus, the carrying-case manufacturer that recently bought Dart, is now offering all manner of cases and mobile accessories online. The site also includes travel tips. 877-[illegible], www.targus.com

PC CONNECTION

A last-minute source for hardware and software. If you place your order by 2:00 A.M. eastern time, you can have it the next business day via Airborne Express. 800-[illegible], www.pcconnection.com

ROAD WARRIOR INTERNATIONAL

Modem Saver line testers and country-specific phone connectors, as well as a way to track FedEx and UPS orders online. 800-[illegible], www.roadwar.com

MOBILE PLANET INC.

Notebooks, international power adapters, and other mobile accessories. 800-675-2638, www.mplanet.com

KONEXX UNLIMITED SYSTEMS INC.

Hardware accessories such as in-line handset couplers, for telecommuting and for voice and data communications. 800-275-6345, www.konexx.com

r and spare battery • Blank floppy disks • In-line RJ-11 coupler • Acoustic handset coupler (especially for international travel) • 12V DC–to–120V AC converter
e tester (tests for unsafe lines) • Toolkit (needle-nose pliers, screwdriver, pocketknife, alligator clips, and flashlight) • Spare pointing stick cap

Back

1. Follow instructions on the other side

GbiSlipBack-0018

Inverted Back

1. Follow instructions on the other side

Folded edge of the page

GbsSlipSheet-001

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

Folded edge of the page

GbsSlipSheet-001

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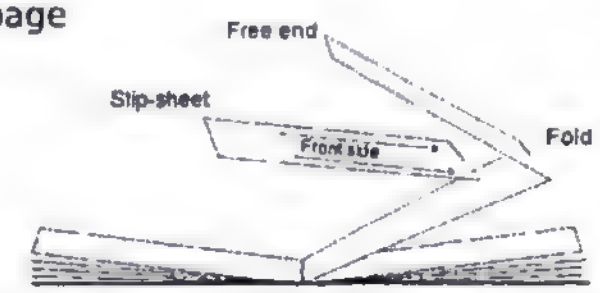

Top Notebook Vendor Support

	CUSTOMER INFORMATION	TECHNICAL SUPPORT	WEB SITE	TECH-SUPPORT HOURS (EASTERN TIME)
Acer America Corp.	800-733-2237, 408-432-6200	800-816-2237	www.acersupport.com	24 hours, 7 days
Apple Computer Inc.	800-538-9696, 408-996-1010	800-500-7078	www.apple.com/support	7:00–7:00 M–F
Compaq Computer Corp.	800-345-1518, 281-370-0670	800-652-6672	www.compaq.com/support	24 hours, 7 days
Dell Computer Corp.	800-388-8542, 512-338-4400	800-247-9252	www.dell.com/support	24 hours, 7 days
Fujitsu PC Corp.	888-466-8434, 408-935-8800	800-838-5487	www.fujitsu-pc.com	24 hours, 7 days
Gateway	800-846-2000, 605-232-2000	800-846-2302	www.gateway.com	24 hours, 7 days
Hewlett-Packard Co.	800-752-0900, 650-857-1501	970-635-1000	www.hp.com/omnibook	24 hours, 7 days
IBM Corp.	800-426-2968, 914-766-1900	800-772-2227	www.pc.ibm.com/support	24 hours, 7 days
Micron Electronics Inc.	888-634-8799, 208-893-3343	888-652-7252	http://support.micronpc.com	24 hours, 7 days
NEC Computer Systems Division	888-863-2669, 508-264-8000	800-632-4525	www.nec-computers.com	24 hours, 7 days
Sony Electronics Inc.	888-531-7669, 408-432-1600	888-476-6972	www.ita.sel.sony.com	24 hours, 7 days
Toshiba America Information Systems Inc.	800-959-4100, 949-583-3000	800-867-4422	www.csd.toshiba.com	24 hours, 7 days

ISP Contact Info

	NATIONAL TOLL-FREE NUMBER (SURCHARGE)	TECHNICAL SUPPORT	CUSTOMER SERVICE	NUMBER OF POPS	ISDN SUPPORT
AT&T WorldNet	800-543-3279 ($6.00/hour)	800-400-1447	800-400-1447	680	Yes (corporate accounts only)
Cable & Wireless USA	800-779-2966 ($5.95/hour)	800-664-7291	800-955-5210	312	Yes
Concentric Network Corp.	800-991-4227 ($5.00/hour)	800-745-2747	800-745-2747	>350 and 19 SuperPOPs	Yes
EarthLink Network Inc.	800-853-7921 ($4.95/hour)	800-395-8410	800-395-8410	>1,500	Yes
GTE Corp.	877-483-7626 ($5.95/hour)	800-927-3000	800-927-3000	>600	Yes
IBM.net	800-590-4857 ($6.00/hour)	800-821-4612	800-455-5056	>500	Yes
MindSpring Enterprises Inc.	Info not available ($6.00/hour)	800-557-9614	800-719-4660	>1,300	Yes

ISPs often prorate hourly surcharges in increments as small as 1 second.

AOL Access Numbers

	AREA CODE	ACCESS NUMBER	HIGHEST ACCESS SPEED SUPPORTED
U.S. CITIES*			
Atlanta	404	720-9500	56K V.90
Austin	512	493-4265	56K V.90
Baltimore	410	752-8348	56K V.90
Boston	617	531-5305	56K V.90
Chicago	312	453-0829	56K V.90
Cleveland	216	902-4859	56K V.90
Dallas	214	210-0646	56K V.90
Detroit	313	989-0923	56K V.90
Honolulu	808	537-5300	56K V.90
Houston	713	300-0126	56K V.90
Las Vegas	702	678-6487	56K V.90
Los Angeles	213	330-0519	56K V.90
Miami	305	702-0001	56K V.90
Minneapolis	612	630-0771	56K V.90
New York	212	655-3001	56K V.90
Philadelphia	215	399-0898	56K V.90
Phoenix	602	605-1881	56K V.90
Pittsburgh	412	471-4474	56K V.90
Portland, OR	503	273-5780	56K V.90
St. Louis	314	802-0104	56K V.90
San Diego	619	881-1663	56K V.90
San Francisco	415	659-2194	56K V.90
San Jose	408	273-1521	56K V.90
Seattle	206	336-6319	56K V.90
Washington	202	478-0572	56K V.90
INTERNATIONAL DESTINATIONS**			
Amsterdam	31	206826015	28.8K
Brussels	32	27052380	28.8K
Cairo	20	24560100	28.8K
Dublin	353	16137000	33.6K
France†	33	836061310	56K V.90
Germany†	49	1914	56K V.90
Hong Kong	852	25199040	28.8K
Mexico City	52	56289393	28.8K
Rio de Janeiro	55	212965323	28.8K
Singapore	65	5468101	28.8K
Sydney	61	284378000	56K V.90
Taipei	886	223560786	28.8K
Tokyo	81	335705051	33.6K
Toronto	416 (area code)	3467288	56K V.90
United Kingdom†	44	8458457445	56K V.90
Vancouver	604 (area code)	6695008	56K V.90

* AOL can be reached from anywhere in the U.S., Puerto Rico, and the U.S. Virgin Islands by calling 800-716-0023. The highest access speed supported is 28.8K, and a 10 cent per minute surcharge applies. ** For international access, a surcharge of $2.95 to $12.00 may apply. † AOL has national access numbers for France, Germany, and the United Kingdom.

CHECK LIST **OPTIONAL ITEMS** Spare notebook battery • Hand-held PC and spare battery • Cellular phone with charger, spare battery, and car adapter • Pag
• Short printer cable • Three-prong–to–two-prong AC adapter • AC extension cord or power strip • Blank courier service airbills and envelopes • Phone-lin

Powerful. Presenting the Portégé® 3110CT notebook. Inside its ultra-thin, ultra-light case, Toshiba gives you the performance edge of an Intel® Pentium® II processor 300MHz, a 6.4 billion-byte hard drive and 64MB of high-speed SDRAM. That's just what it takes to handle a heavy workload on the run with an ultraportable PC that won't weigh you down.

Productive. Portégé 3110CT comes equipped with a brilliant 10.4" dia. Poly-silicon TFT color display and an innovative touch type keyboard with a comfortable, full-size feel. An integrated V.90/K56flex modem* provides high-speed communications. And a battery lasting over 3 hours** lets you get more done, more easily than ever. Of course you'll also have Toshiba's dependable 24/7 support.

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intel inside
pentium II

Pure power.

Pure portability.

Pure precision.

Flexible Expansion. Link to your network with built-in 10/100 Ethernet capabilities. Access the optional CD-ROM, and tap into the rest of your office resources with a standard Network I/O Adapter that gives you easy, one-touch connections to your existing peripherals. A maximum 128MB memory capacity also leaves room to grow for tomorrow's demanding tasks.

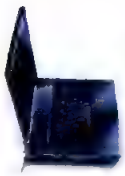
Ultra-thin. Ultra-light. The innovative technology of the Portégé 3110CT is evident even before you open it. Under 1" thin and barely 3 lbs. light, its sculpted magnesium-alloy case is engineered for protection as well as sophistication. Discover the pure power, portability and precision of the Portégé 3110CT for yourself. Call **1-800-TOSHIBA** or click on **www.toshiba.com**.

TOSHIBA

The World's Best Selling Portable Computers.

The ultimate strategy for power and performance.

12,600 possible configurations. A single image encompasses a diverse range of user requirements. Including optional DVD-ROM or CD-ROM, a V.90/K56flex modem*, various processors and a range of memory, hard disk drive and display choices. Never has one platform done so much for so many, so easily.



Lower total cost of ownership. Protect the performance of your investment with a stable architecture and docking station compatibility that helps reduce your total cost of ownership. Choosing Tecra is an unbeatable strategy. And your next move is as simple as calling **1-800-TOSHIBA** or clicking on **www.toshiba.com**.

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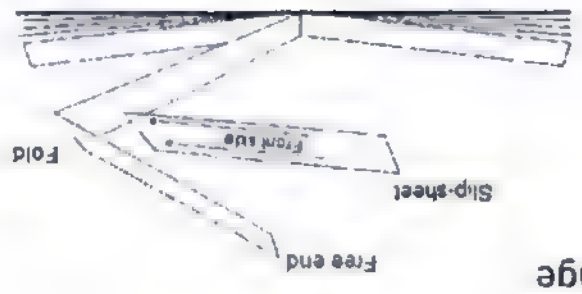
The World's Best Selling Portable Computers.

Folded edge of the page

GbsSlipSheet-001

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Foldout slip-sheet

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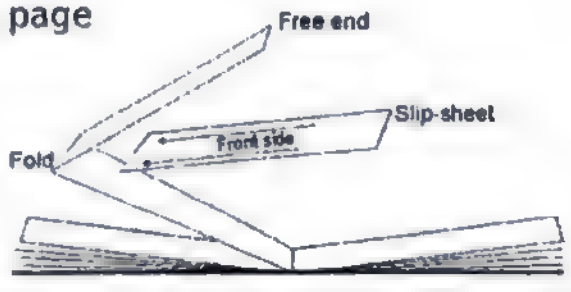
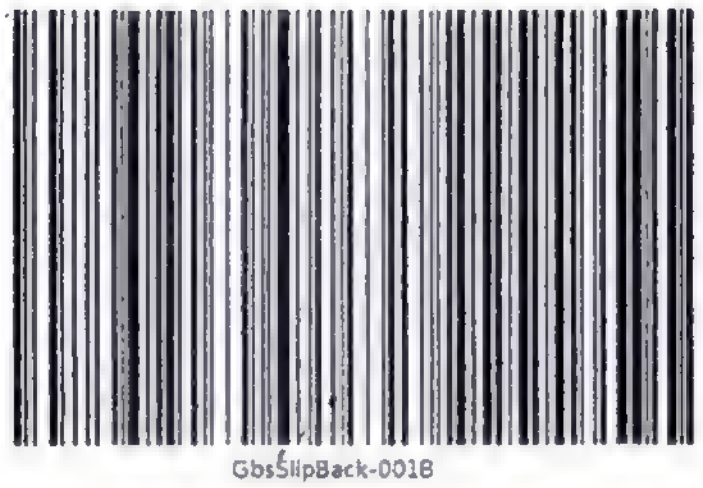
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Back

1. Follow instructions on the other side



Back

1. Follow instructions on the other side

PC Magazine
1998 Technical Excellence Award
"Best New Product"

Cutting-edge performance. Lightning-fast Intel® Pentium® II processors 400MHz, with 256KB integrated Level 2 cache, give Toshiba's newest Tecra® 8000 notebook world-class performance. Plus you get massive hard drives up to 14 billion bytes, and brilliantly colorful 14.1" dia. TFT active-matrix displays.

One motherboard. One image. Count on a single platform and system image with a consistent motherboard, chipset, memory subsystem, system BIOS, graphics and audio/video controllers. So when you qualify one stable, Y2K-compliant Tecra 8000, you've qualified them all—saving valuable time and money.

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Travel Tips *to make life a little easier*

PROTECT YOUR MODEM. Buy a modem (or a portable modem protector) that has a digital-line guard. This will keep your modem from being damaged if you accidentally plug it into a digital PBX or ISDN phone jack.

DISABLE CALL WAITING. Data transfers can be cut off by Call Waiting. Dial *70 (or 1170 from a rotary phone) to disable the feature. If *70 doesn't work, try #70, 70#, or 70".

PRINTING. Install popular printer drivers on your notebook (such as those for the HP LaserJet and DeskJet printers, along with generic "text-only" drivers) so you can print anywhere, on almost anyone's printer. The Web sites for HP (*www.hp.com*) and Microsoft (*www.microsoft.com*) offer downloadable printer drivers, as do other sites. You can also use your fax modem to "print" to a fax machine.

IN-LINE HANDSET COUPLER. This device lets you connect to the handset jack on any phone, including digital PBX phones (as opposed to the RJ-11 jack in the wall). This avoids the damage that can be caused by plugging a PC Card modem into a digital phone jack, as well as the hassle of crawling around on the floor looking for the wall jack. (See "Travel Accessories" for listings of dealers.)

LONG-DISTANCE CARRIER CODES. Dial one of these six-digit prefixes before the area code to use the following long-distance carriers.

- AT&T: 102880 (or 800-Call-ATT)
- MCI: 102220 (or 800-Collect)
- Sprint: 103330 (or 800-One-Dime)

HIGH-SPEED CONNECTIONS. More and more airports and hotels that cater to business travelers are adding high-speed connections such as DSL and cable modem. For instance, Wayport (*www.wayport.net*) offers fast connectivity in hotels in Hershey, Pennsylvania, as well as Austin and Dallas (with more to come). Other companies that offer similar services are LodgeNet (*www.lodgenet.com*, for hotel chains including Sheraton, Ritz-Carlton, and Red Roof Inns), CAIS (*www.cais.com*, with notable partners including Hilton Hotels), Atcom (*www.atcominfo.com*, for airports in New York, Chicago, Boston, and San Diego, to name a few), and STSN (*www.STSN.com*, which has partnered with Marriot).

PROVIDER	PARTICIPATING AIRPORTS	TYPE OF CONNECTION (COST)
Atcom/INFO	Boise; Dallas/Ft. Worth; Denver; Des Moines; Duluth, MN; Eugene, OR; Fargo, ND; New York (La Guardia)	Ethernet (varies)
Gst2Net Corp.	Boston; Charlotte, NC; Chicago, Newark, New York (Kennedy and La Guardia); Norfolk, VA; Richmond, VA; Windsor Locks, CT	T1 (free; ad-based)
LaptopLane Ltd.	Atlanta; Chicago; Cincinnati/Northern Kentucky; Seattle/Tacoma	Modem, T1 (5 minutes, $2.00; 38 cents each additional minute)
PowerOasis Inc.	Anchorage; Middletown, PA; Newark; Ontario, CA; Philadelphia; Washington (Baltimore/Washington and Dulles	Modem (50 cents/minute)
QuickATM Corp.	Denver, Los Angeles, Minneapolis/St.Paul, Newark, San Francisco	T1 (10 minutes, $2.50)

Connected Layovers

HOTEL	AVAILABILITY	TYPE OF CONNECTION
Best Western	Being tested	Info not available
Courtyard by Marriott	Being tested	Ethernet
Doubletree	Austin, TX; Costa Mesa, CA; Denver; Las Vegas; Minneapolis	Ethernet
Embassy Suites	Memphis, TN	Ethernet
Four Seasons	Austin, TX; Los Angeles	Ethernet
Hilton	Being tested	Ethernet/radio wireless
Hyatt	Being tested	Ethernet, T1
Marriott	Being tested	Ethernet
Meridien	Being tested	Info not available
Radisson	Being tested	Ethernet
Rosewood Group	Being tested	T1
Ritz-Carlton	Being tested	Ethernet
Sheraton	Info not available	Info not available

SECURITY TIPS

Don't lose sight of your notebook case as you go through airport security or wait for the plane at the gate. Remember that the X-ray machine will not damage your PC.

Use the motion-sensing Port Defcon 1 notebook alarm ($49.95 direct, from Port Inc., 800-242-3133) to protect your computer. Be kind to your maid and leave a warning note.

Use a Kensington MicroSaver lock ($40 street, 800-535-4242) or a similar device to secure your notebook to a desk.

Tape business cards or address labels to your notebook and AC adapter, but don't cover vent slots. Write your name on your PC Cards as well.

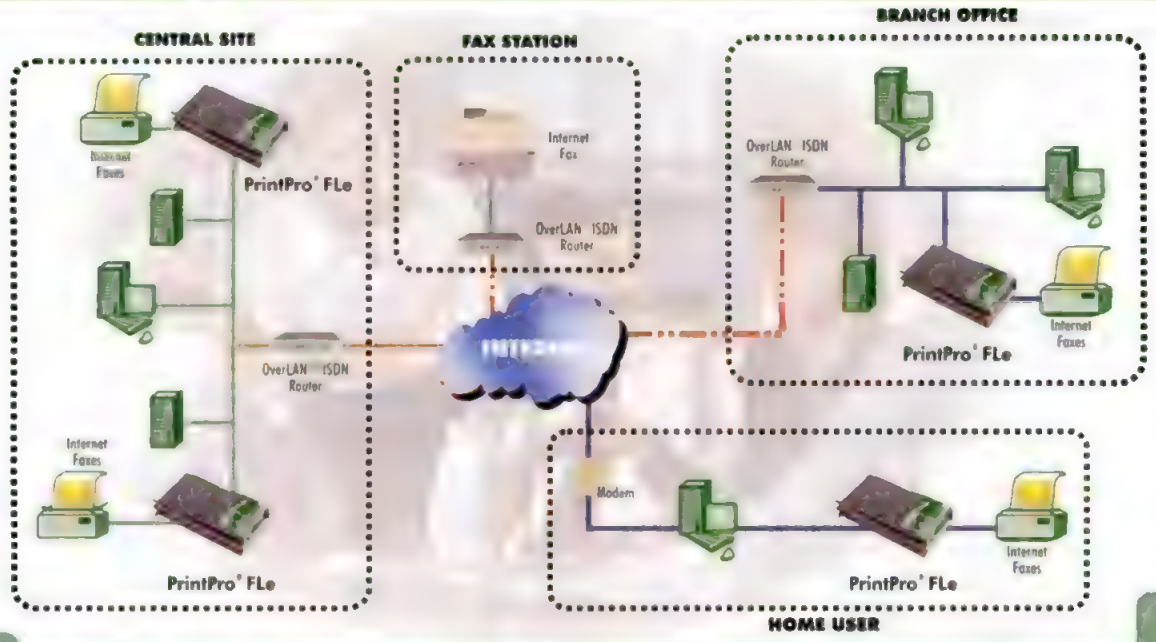
Use your notebook's password protection utility to provide a layer of protection for your data.

Always shield public phone keypads when using your card number.

Plug the phone cord from your modem into an in-line coupler or a Y connector to protect the levers from snagging and breaking. This is especially handy for proprietary PC modem cord dongles.

CHECK LIST **IMPORTANT TASKS** ■ Charge your notebook battery ■ Change your voice message ■ Set up your desktop PC for remote access ■ Transfer working files to your notebook ■ Get dialing codes for international travel ■ Get toll (non-800) phone numbers (for international travel)

Directly print Internet faxes & e-mail



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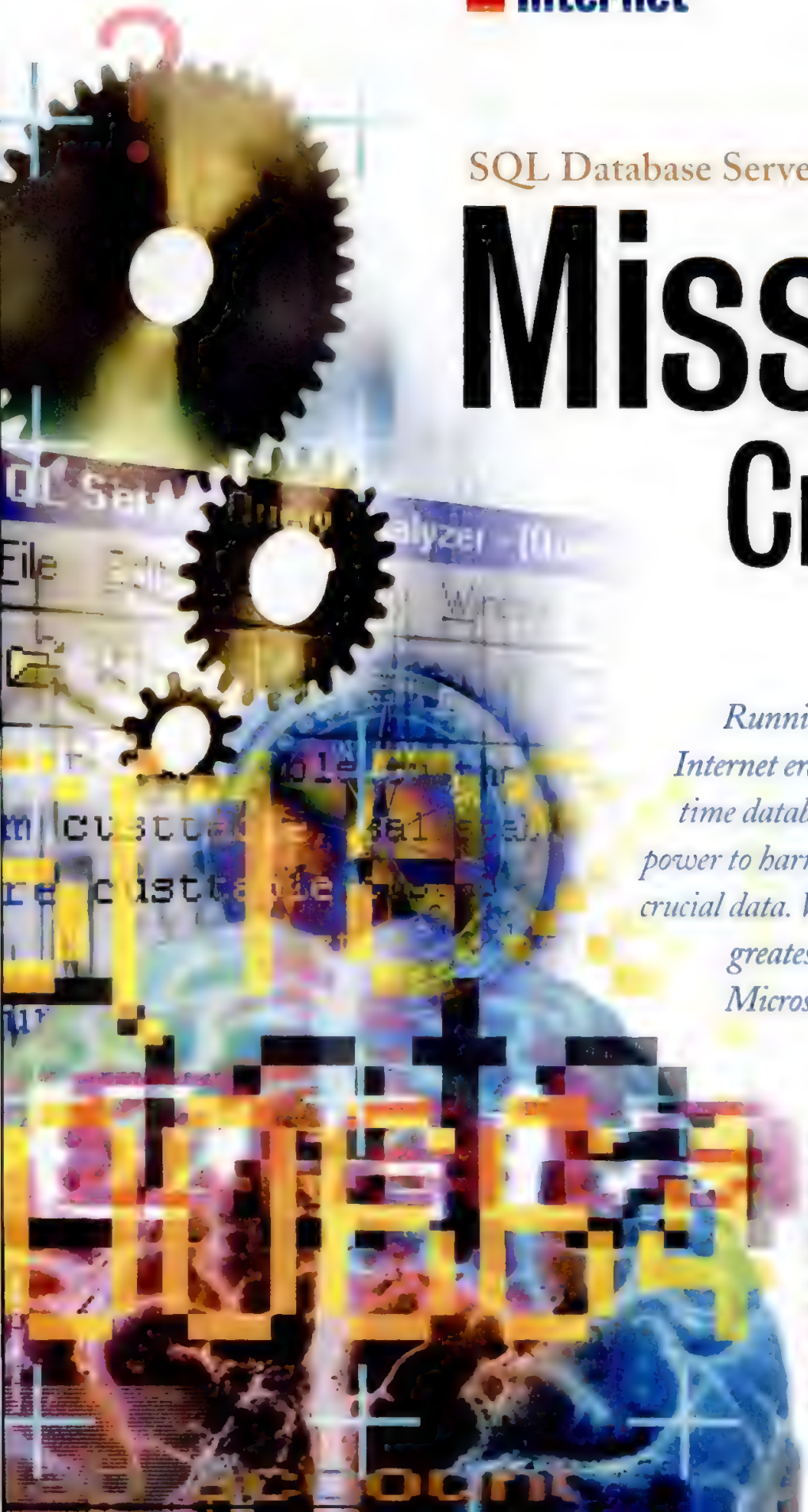

SQL Database Servers

Mission Critical

By Timothy Dyck

Running your company in the Internet era is a tough task. A big-time database gives you unbridled power to harness all of your business's crucial data. We look at the latest and greatest from IBM, Informix, Microsoft, Oracle, and Sybase.

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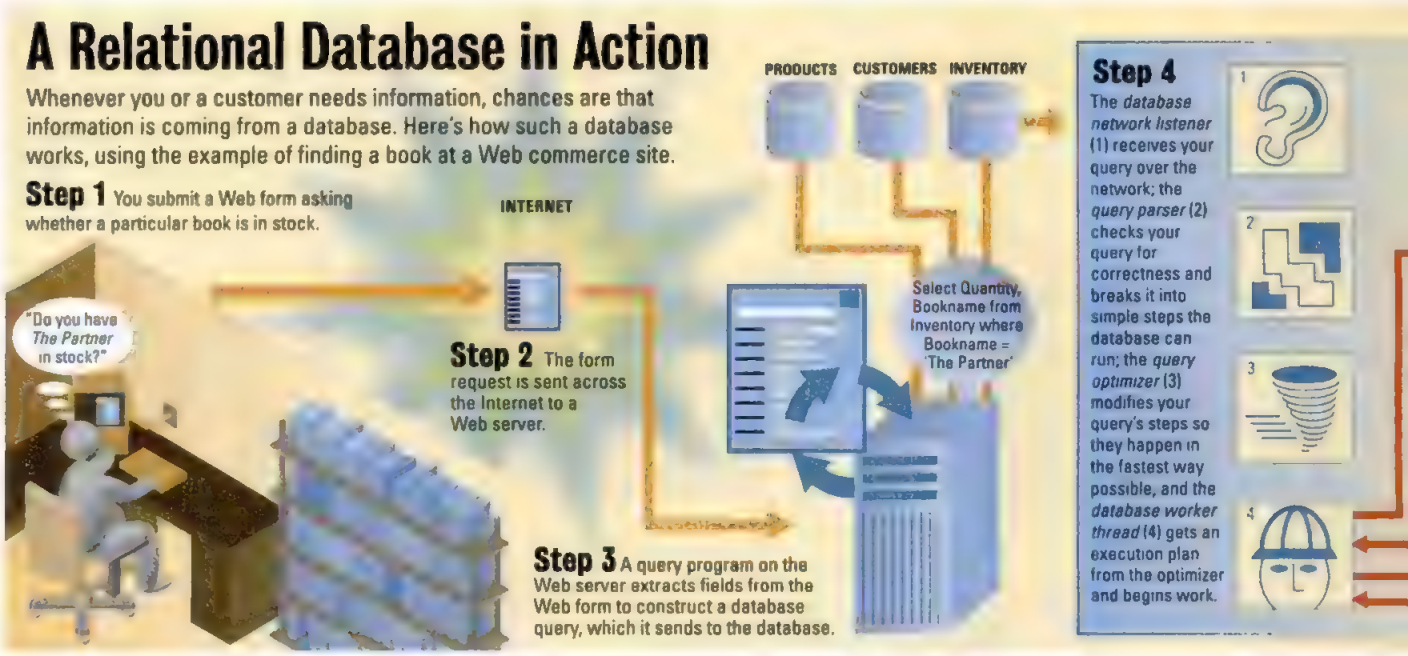

Quick! What's the most important piece of technology your business uses?

Telephone lines and network routers are key parts of your business's nervous system; they move vital information from where it's stored to where it needs to go. Your database, however, is your business's brain. It contains all the critical customer and business-process information necessary to keep your operation alive.

If your database can't connect with the rest of your software and hardware or is running too slowly, your staff can't take orders, look up prices, or check product availability. They won't know whether the person on the phone placed a million dollars or only $10 in orders last year. They won't even be able to look up the number for technical support; the online phone directory will be flat on its face too. Without data, your business is just plain DOA.

PICKING THE RIGHT DATABASE

That's why picking the right corporate database for your needs is so important. Key factors to consider are the maximum number of users you expect will be accessing the database at any one time, the level of uptime you need, the types of programs you'll be using to access information in the database, the server hardware and operating system the database will be using, and the level of in-house expertise you might already have in a particular database.

Another option to consider is outsourcing your database needs, an approach that companies like Oracle have been pushing recently. This makes sense if your organization doesn't have any database expertise in-house or if it faces occasional increases in database loads. The specialized knowledge and resources of an outsourcer can help in these situations.

Your database contains all the critical information necessary to to keep your operation alive.

For this story, we focused on the needs of a small to medium-size business with between 25 and 300 employees who require database access. The business has a midsize in-house server system that is dedicated to running its database (for details on our actual setup, see "How We Tested"). It has also asked one person from its small IT staff to administer the database while continuing to do other jobs. Our model company also has a few branch offices connected to headquarters using a wide area network, and the employees there need access to the database as well.

A server database can be used many different ways—for example, taking orders from sales staff or from users on a Web storefront, running end-of-month reports, and processing ad hoc sales-analysis queries of a data warehouse. We wanted a jack-of-all-trades server database that could handle all these jobs reasonably well, taking the load but not breaking the bank. In particular, we emphasized the cost and complexity of database administration, the ease of Web connectivity, the speed and feature set of the database server engine itself, support

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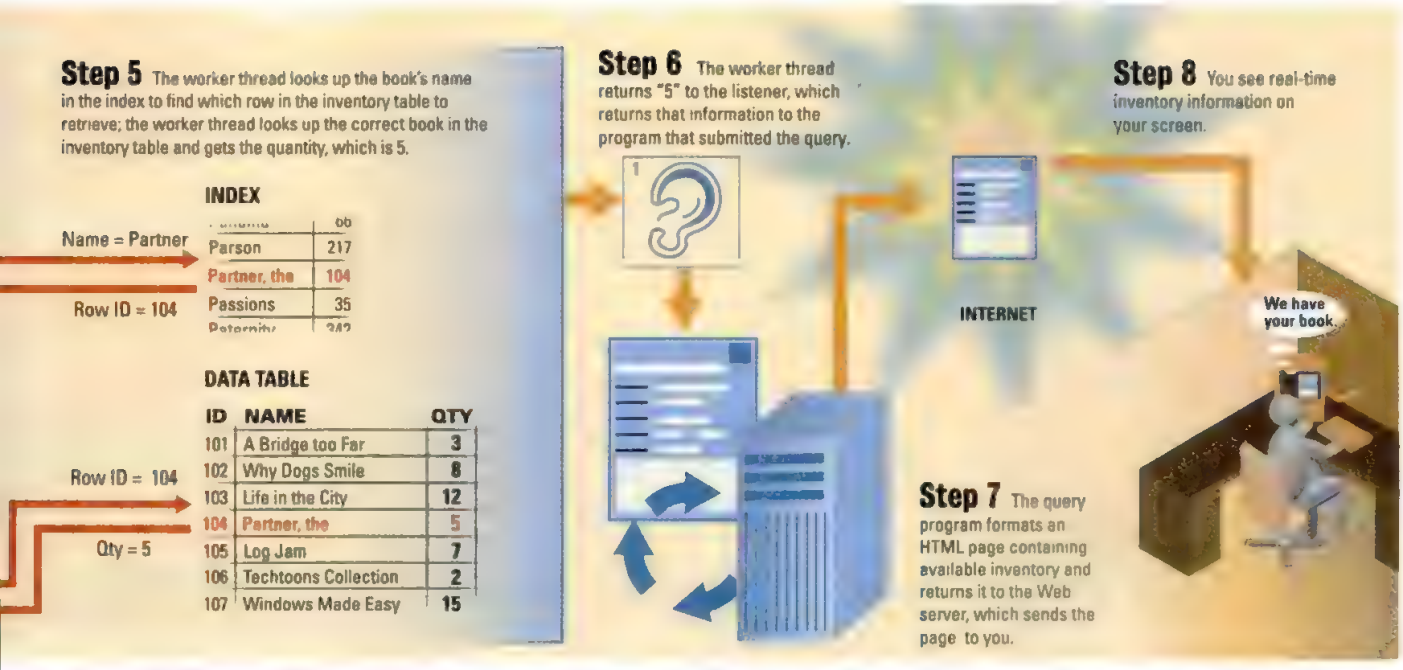
ILLUSTRATION BY MARK TYNER



for branch offices and the mobile sales force, and the ability to store and analyze large sets of historical data efficiently (called *data warehousing*).

THE PLAYERS

To help you make this difficult decision, we picked four of the world's top server database packages—IBM DB2, Microsoft SQL Server, Oracle8i, and Sybase Adaptive Server Enterprise—and brought them into our labs to see how they stacked up against each other. We ran them through all of the tasks that you'd do every day in running your database: configuring, monitoring, tuning, querying, programming, and analyzing the database and its contents.

Our primary focus is on the products that are currently shipping: Microsoft SQL Server 7.0 and Oracle8i 8.1.5. Additionally, we had beta code for the upcoming releases of IBM DB2 and Sybase ASE and put them through the same rigorous testing as Microsoft and Oracle. We also offer you an early preview of the long-awaited update to Informix's database, code-named "Centaur."

All of these databases are based on the database language SQL (structured query language), a worldwide standard for entering and retrieving information from server databases. They were designed from the start to support hundreds or thousands of simultaneous users logging on from around the world and to make sure those users don't step on each other's toes. The servers can easily support millions of customer records in thousands of separate database tables. They all have sophisticated security controls and can be customized to fit particular business needs. They're the kind of products a company must have when it has too many users or more complex requirements than desktop databases like FileMaker Pro or Microsoft Access can handle.

We are not publishing benchmark test results in this story. Given the appropriate hardware, any of the databases we evaluate will be fast enough for most applications you will need. But if you will have hundreds of users accessing the database simultaneously or have a database more than 5GB in size, you'll want to make sure the product you're considering can handle the load.

We did create a series of tests based on the industry-standard AS3AP benchmark tests to help you decide which database best handles such intensive applications. Each vendor's licensing agreement prohibits the publication of performance test results without the vendor's consent.

We have made our test specification available for download (*http://cqi.zdnet.com/slink?3220*). For more information, see "How We Tested" in this story and "Inside PC Labs" earlier in this issue. If performance is an important factor in your decision, we strongly recommend that you work with all prospective vendors and get assurances that the database will be able to handle your workload.

BIG CHANGES IN THE MARKETPLACE

With each major database vendor either having recently released a new version or being on the verge of doing so, our testing helps bring a few big trends into focus. First, server hardware becoming cheaper and faster since the last round of major database updates now makes it possible for midsize companies to run their corporate database systems on $15,000 servers.

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On our tests, with 300 simultaneous user connections on a dual–Pentium III server with 512MB of RAM, we measured thousands of simple transactions or hundreds of complex, multistep transactions a second. While your organization might want to buy multiple servers for redundancy, you won't need to spend big bucks on hardware to get big performance.

Second, the Internet has really influenced the database market. Database vendors are pouring money into adding Java support and seamless Web connectivity to their products. Every vendor in this story, with the exception of Microsoft, has embraced Java to some degree to make its products more programmable and compatible with Web-based applications.

Third, data warehousing, once so expensive and obscure that only the biggest companies could afford to use it, has come of age. Just about any firm can now effectively mine its data to monitor its business.

All of these trends only make a database more central to your enterprise than ever. Whatever your business's needs are, you'll find a product here that can help put your company where you want it to be well into the next century.

Microsoft SQL Server 7.0

For five users, $1,399 (list); each additional user, $127. Redmond, WA; 800-426-9400; www.microsoft.com/sql.

Packed with more features than competing products and sporting a very attractive price, Microsoft SQL Server 7.0 is a modern, full-featured SQL database that's right on target for the small or midsize organization. Its complete set of tools, high-end engine features, and robust analysis capabilities provide most of what IBM and Oracle offer only in their Enterprise Edition databases (and a few key things that neither includes) for less than either one. In addition, we found SQL Server 7.0 amazingly easy to use, yet still powerful enough to crank through hundreds of complex transactions a second on our test hardware without choking. (SQL Server also comes in an Enterprise Edition version, whose main benefit is to allow automatic failover to a secondary, standby machine.)

Editors' Choice

• Microsoft SQL Server 7.0

The database is the heart and soul of any company's business infrastructure. Small to medium-size businesses planning to make this critical investment must consider their specific business needs, support requirements, and budgets. The solution that offers the best value with the least administrative hassle is Microsoft SQL Server 7.0, and we award it our Editors' Choice.

In the small-business market, the differentiating factors are ease of database administration, Web connectivity, the speed and features of the database server engine, branch-office and mobile support, and the ability to warehouse data efficiently. SQL Server 7.0 shines in all of these areas except Web connectivity. Its administration tools include many wizards and self-tuning settings that make it the only database we reviewed that might not require a specially trained administrator.

For branch offices or distributed sales teams, SQL Server's per-seat client license includes the right to run its desktop version, and the database has excellent replication features that let you sync up with home base and vice versa. An OLAP server in the box lets you store and analyze all the data you have. All this comes at a fraction of the cost of competing databases.

Oracle8i has some excellent features, including its multiversioning concurrency system, and its Internet-centric approach is the way of the future. But with the database server still more difficult to administer than the others we saw, and at its high prices (especially when many key features, standard elsewhere, are available only at an extra cost), Oracle is hard to recommend unless you're building a custom application that requires its Java or multimedia features.

Although we didn't see final code, IBM DB2 impresses with its stellar server engine, multimedia support, and Java programmability—all areas where it surpasses what Microsoft SQL Server provides. It costs more and will require more care and feeding than SQL Server, but this is one to evaluate seriously as you make your buying decision.

Yet SQL Server still lags behind the competition in two key areas: programmability and multimedia data support. For those who write their own business applications and put part of the code in the database itself (as opposed to putting all the code into applications that run on your Windows client systems), and for those who are moving to HTML- or Java-based database client applications, SQL Server provides less built-in functionality and will be harder to use than DB2, Informix, Oracle, or Sybase.

SQL Server also runs only on Windows operating systems, so if you're running Unix-based servers, look elsewhere. But if you're running generic packaged Windows applications to access your database contents, or if you have custom applications that use only the ODBC standard to get information from the database, you'll be right in SQL Server's sweet spot.

HEART AND BRAIN TRANSPLANTS

Version 7.0 is more than just an upgrade of SQL Server 6.5. It has a new heart and brain in its latest incarnation. Think of 7.0 as a totally new database that just happens to have somewhat similar administration tools and to use the same programming language (Transact-SQL).

Microsoft has made a whole host of changes to bring its enterprise database up to technical snuff. SQL Server's engine—the heart of the product— now has a different data file format than its predecessors had.

SQL Database Glossary

Enterprise JavaBeans A Java standard for creating reusable server components for building applications. They facilitate writing code that accesses data in a database.

Index A special database object that makes finding information in a database table much faster by storing pointers to where needed data resides on-disk. Indexes are essential for good database performance.

Intraquery parallelism Using more than one CPU to execute a single database query. This is easily confused with *interquery parallelism*, where separate queries are run in parallel (on different CPUs). Intraquery parallelism is a new feature for the database industry; interquery parallelism has been around for many years.

Isolation level A database setting that defines the extent to which simultaneous users of the database can affect each other's work. There are three commonly used isolation levels: read committed (high concurrency, low isolation), serializable (low concurrency, high isolation) and repeatable read (a balance of the two).

JDBC Java Database Connectivity; a Sun Microsystems standard defining how Java applications access database data.

Join The process by which you combine information from two tables by matching data in two similar columns.

ODBC Open Database Connectivity; a Microsoft standard defining how Windows applications access database data. ODBC is slowly being replaced by *OLE DB*

OLAP Online analytical processing; a data analysis technique where commonly requested information like sums or counts is calculated before it is needed to speed query times.

OLE DB Object Linking and Embedding Database; a new Microsoft standard defining how applications access database data. It has extensions for *OLAP* servers as well as special support for multimedia data.

SQL Structured query language; an industry-standard language for inserting, updating, deleting, and retrieving data from a relational database.

Stored procedure A program running in the database that can take complex actions based on the inputs you send it. Using a stored procedure is faster than doing the same work on a database client, because the program runs right inside the database server.

Table The grouping of information in a relational database. Tables are composed of columns and rows.

Transaction A set of database operations that cannot be interrupted. All database operations in a transaction must be completed successfully for changes from any operation to be made permanent. All the databases reviewed in this story support transactions. Desktop databases such as Inprise's Visual dBASE and Microsoft Access do not support transactions.

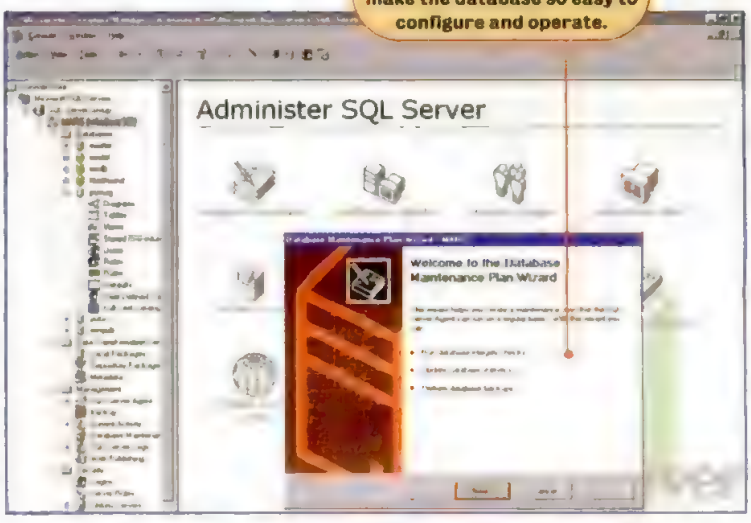
Trigger A program in a database that gets called each time a row in a table is inserted, changed, or deleted. Triggers allow you to check that any changes are correct before they are accepted.

One of the key reasons for changing the database file format is a switch to using 8K disk pages (the basic unit of database storage) instead of 2K pages. This permits storing more information in any database row and also makes the database faster when reading in many rows at a time, since the server has to retrieve fewer data pages from disk.

Also, SQL Server can now isolate data and index information at the row level (a feature called *row-level locking*). Previously, SQL Server could protect one user's changes from the activity of other users only by blocking other users' access to a group of perhaps 40 or 50 rows (depending on the size of a row) around the one being changed. SQL Server 7.0 locks down only the actual rows being changed and, as a result, can support more users at once. Some packaged business applications, like those from PeopleSoft and SAP AG, really need row-level locking to be at all usable.

The query optimizer—SQL Server's brain—also got a total rewrite. Most important, it now supports *intraquery parallelism*, the ability to process a single query on multiple CPUs. This speeds up queries so much that you should consider the feature a must-have for your database software if you have a multi-CPU server.

All these low-level enhancements translate into big performance gains, especially on multi-CPU servers. In the March 1, 1999 issue of our sister publication *PC Week*, benchmark tests run on a four-CPU server showed that SQL Server 7.0 cut the run times for data analysis queries to a third of what they'd been on Version 6.5. Not all queries got this much faster, though: On the *PC Week* tests, SQL Server 7.0 handled short, order-entry–type queries at about the same speed as SQL Server 6.5.



The Maintenance Plan Wizard is one of 23 wizards in Microsoft's database administration tool Enterprise Manager, which make the database so easy to configure and operate.

TOP-NOTCH TOOLS

Beyond all its engine changes, SQL Server includes an unmatched set of database tools. New with this release is a server product called SQL Server OLAP Services (*OLAP* stands for *online analytical processing*). It's a specialty-purpose database server that precalculates summary information for easy analysis and comparison.

For example, we used OLAP Services to view sales figures by store, by town, by region, and by country, and then compared last quarter's figures with those of this quarter. Since the totals had all been figured out ahead of time, we could flip instantly between high-level totals. With other OLAP servers currently priced at tens of thousands of dollars, OLAP Services is an incredible bargain.

OLAP Services is powerful, flexible, and easy to use, but it's not all roses. First, you have to buy separate, compatible software to use it, because OLAP Services uses a query language different from the one SQL Server uses. (Excel 2000 is one such client, but others are available from companies like Cognos Corp. and Seagate Software.)

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	Microsoft SQL Server 7.0	Oracle8i Standard Edition (with JServer and interMedia options)
SERVER ADMINISTRATION	**Excellent**	**Good**
Graphical tools	Excellent	Good
Ease of maintenance	Excellent	Good
SERVER ENGINE	**Excellent**	**Good**
Support for multiple CPUs	Excellent	Fair
Join and index selection	Excellent	Excellent
Degree of concurrency	Good	Excellent
MULTIMEDIA DATA HANDLING	**Poor**	**Excellent**
Web connectivity	Poor	Excellent
Support for sound, media, video, images	Poor	Excellent
Full text search	Good	Excellent
INTEROPERABILITY	**Good**	**Fair**
Links with other databases	Good	Poor
Single log-on	Good	Good
Operating-system support	Fair	Good
PROGRAMMABILITY	**Fair**	**Excellent**
Stored procedures and triggers	Good	Excellent
Internal programming language	Poor	Excellent
DATABASE DESIGN	**Good**	**Excellent**
SQL language support	Excellent	Excellent
Object-oriented design	Poor	Excellent
BRANCH OFFICE SUPPORT	**Excellent**	**Excellent**
Replication	Excellent	Excellent
Distributed transactions	Excellent	Excellent
Remote administration	Good	Excellent
DATA WAREHOUSING AND REPORTING	**Excellent**	**Good**
Loading tools	Excellent	Excellent
Analysis features	Excellent	Poor

How We Tested

Our testing focused on the database needs of a small to medium-size business, with 25 to 300 employees with access to the database and either a part-time database administrator or none at all. Therefore ease of configuring and monitoring the database were key points in testing.

In our features script, we created users and database objects, set security permissions for those users, and monitored database activity using a mix of easy and difficult queries. We also used any tuning tools provided to try to optimize some complex, poorly written SQL queries to see how much help we could get for maximizing hardware performance.

Databases that made our coding job easy and supported standard programming languages such as Java did well. We also imported a set of test images, video clips, text documents, and geographic mapping data to test how well the database managed these data types, which are becoming so important in Web applications.

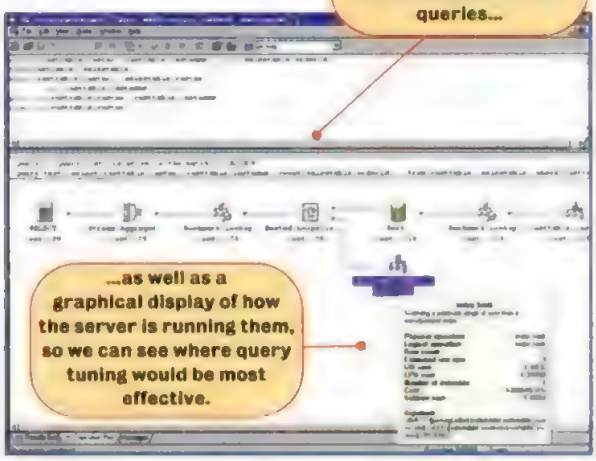
Another priority was seeing how tested databases handled a wide variety of database activity. In particular, we tested products with online transaction processing queries (which are simple and fast, stressing networking code, the database lock manager, and query parser) and decision support queries (which are complicated and long, stressing the query processor, optimizer, and storage engine).

We had a full performance test suite prepared for this story, based on the AS3AP (ANSI SQL Standard Scalable and Portable) database benchmark tests published by researchers at the University of Illinois at Chicago and Sun Microsystems. As control logic, we used Client/Server Solutions' Benchmark Factory 97 (*www.benchmarkfactory.com*).

We had planned to run comparison tests of both shipping products, Microsoft SQL Server 7.0 and Oracle8i. But Oracle was not willing to participate, and thus we are not publishing performance test results. See "Inside PC Labs" in this issue for details.

For features testing, we used four single Pentium Pro or Pentium II servers, each with 128MB of RAM, as well as one dual Pentium III/450 server with 512K of RAM, equipped with a RAID 0 array of 8GB Ultra2 Wide SCSI disks, running Windows NT Server 4.0. We interconnected all systems using Intel PRO/100+ network adapters and a 100-Mbps Intel Express 510T network switch.—*Analysis written by Timothy Dyck and Jay Munro*

Second, SQL Server doesn't make any use of OLAP Services (or of precalculation techniques in general) to speed up its own queries. The two are completely separate products; we had to load data from SQL Server into OLAP Services before we could do any OLAP analysis. By contrast, both IBM and Oracle have introduced some OLAP features directly into their latest databases, in the form of query summary tables.



EASE-OF-USE LEADER

Microsoft SQL Server 6.5's administration tools were decent, but SQL Server 7.0 takes ease of use to a whole new level. Many engine settings in SQL Server 7.0 are self-tuning. For example, we didn't have to assign memory to our data cache and stored procedure cache separately; SQL Server dynamically balanced memory between the two. SQL Server also expands or contracts the amount of memory it is using as a whole: We watched it automatically make room in memory for other applications when they were running, and expand again to fill extra memory when we closed them down.

Automatic memory tuning isn't especially important on a dedicated database server machine. But on a server that has to run other applications like a mail server and Web server at the same time as a database, dynamic memory sizing makes a huge difference to system usability.

SQL Server can now run on Windows 9*x* systems, a very handy feature for organizations with mobile sales forces. Each salesperson could use locally installed database applications, such as an order-management system, and then synchronize customer and order data with headquarters as necessary.

Also boosting branch office support, SQL Server 7.0 includes competitive repli-

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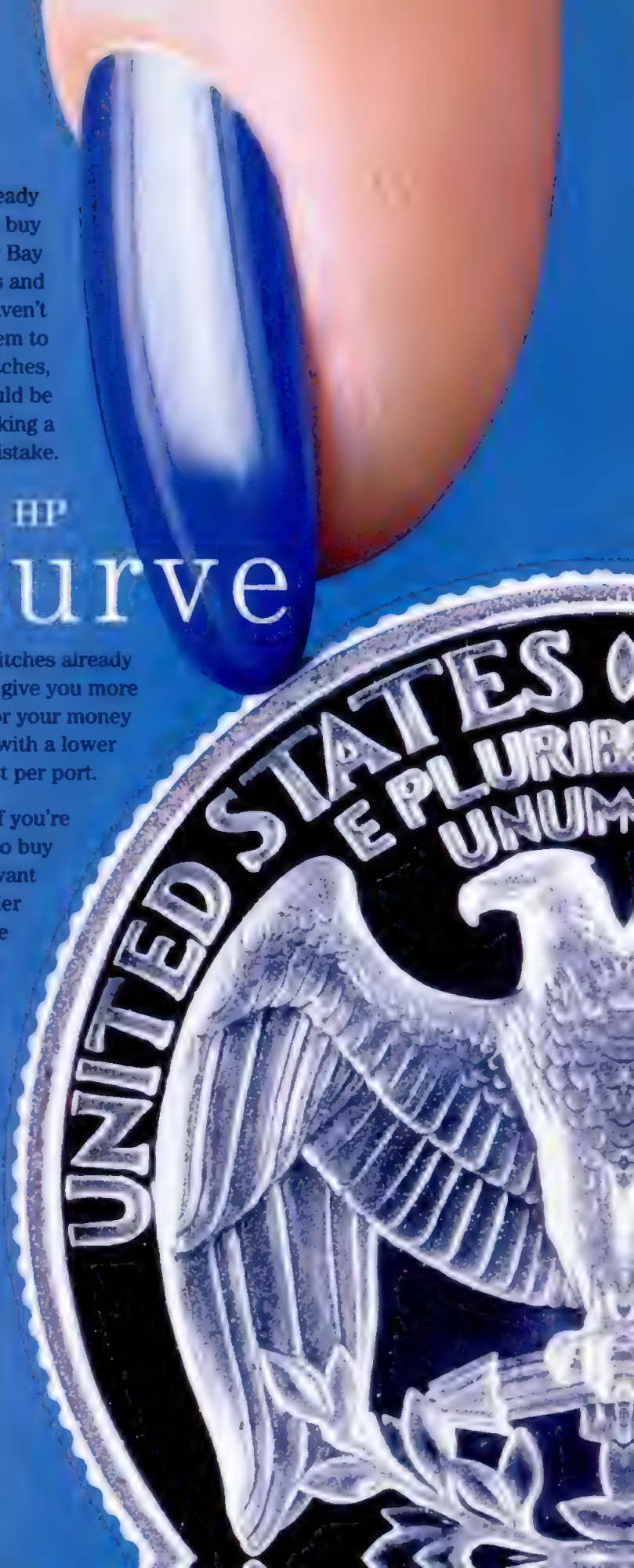

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3Com SuperStack II 3300	$169 per port
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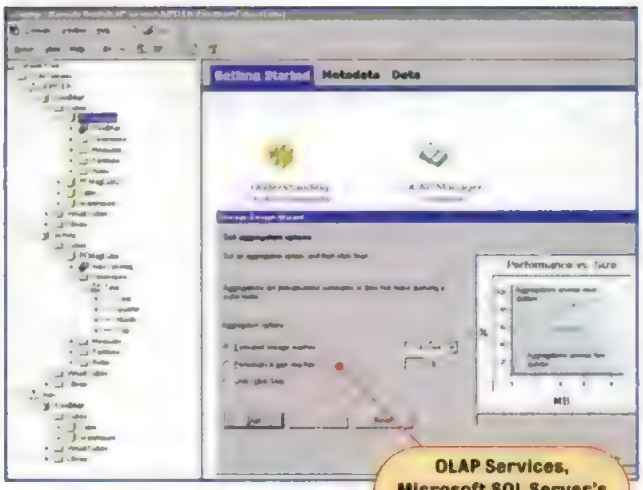
cation features that support a number of one-way and bidirectional links between SQL Server machines. As a result, databases in branch offices and headquarters automatically keep each other in sync.

SQL Server's unmatched autotuning features mean it is the best choice for organizations that don't have database administrators on staff. While a good DB2, Oracle, or Sybase administrator can manage several hundred database servers from a central location, you do need at least one experienced administrator to use these databases effectively. SQL Server can get by with a part-time or beginner administrator quite well.



OLAP Services, Microsoft SQL Server's data analysis server, lets you optimize for faster performance or more free disk space, whichever is right for you.

Another interesting new tool in SQL Server 7.0 is the Index Tuning Wizard (part of SQL Server's Profiler tool). It suggests new server indexes based on actual database usage (*indexes* are special database objects that speed the process of looking up information in a database table, and they are essential for getting good database performance). We were able to turn on index data capturing, run a set of queries against SQL Server, and see what index suggestions the wizard made. It then asked us whether it should go ahead and create the new indexes for us, providing one-step tuning. IBM and Oracle also offer similar tools, but Microsoft's Index Tuning Wizard has a small edge over those offerings, because its options for capturing database activity are more flexible.

PROGRAMMING PITFALLS

As we mentioned, SQL Server still offers only the same old cumbersome Transact-SQL programming language it always had. While everyone else in the SQL database market is moving (or has already moved) to a modern programming language like Java, SQL Server customers are still stuck in the programming Dark Ages—no object-oriented development, no big class libraries to use, and no code interoperability with anything else. Although it's certainly possible to create large applications using Transact-SQL, you're in for a lot of work.

The same applies to companies that want to store multimedia data (such as the contents of a Web site) in their databases. While DB2, Informix, and Oracle go out of their way to make this easy, SQL Server has no special image, sound, video, or geographic data support. You'll need to purchase a third-

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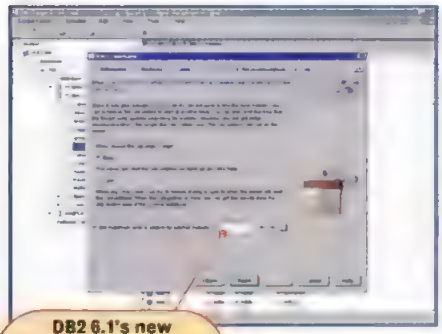
Preview:

IBM DB2 6.1

The result of almost 30 years of database research, IBM DB2 can run your small business as well as it can manage your bank's business—which is pretty well indeed. DB2 6.1, the latest in a series of big upgrades to DB2 over the past two years, wraps one of the best-designed sets of administration and tuning tools on the market with a database engine that scales from a glued-together plastic laptop running Windows 95 up to a cluster of S/390 mainframes running OS/390.



DB2 6.1's new Index SmartGuide makes it easy to tune your database for the kinds of queries you submit.

DB2 6.1 (replacing the current DB2 5.2) is due to hit shelves around the time this issue comes out. We tested beta 2 code of DB2 6.1, which was complete except for some bug fixing and performance tuning.

There are two versions of DB2: DB2 Workgroup, which costs $999 per server and $249 per concurrent user, and DB2 Enterprise Edition, which is $12,500 per CPU, with unlimited users.

WORKGROUP DELIVERS THE GOODS

Pricewise, DB2 Workgroup delivers great bang for the buck. It includes all of DB2's advanced database engine technology, such as parallelism within a single query, full replication support, query summary tables to speed up database performance, object-relational database design, and Java programming support. Its only license limitations are that it can't be used on machines with more than four CPUs and doesn't include DB2 Connect, IBM's gateway to DB2 on the mainframe.

DB2 also has a full set of multimedia extensions for storing and manipulating full-text, sound, video, image, and geographic data. These extensions make designing Web-based applications and applications that include photos or long text reports much easier. They're extra-cost options, but they offer features and pricing that are very competitive with those of Informix and Oracle.

DB2 is competitive as an applications development platform as well. We could use Java to code database logic, and a new tool in DB2 6.1—Stored Procedure Builder—automatically turned a SQL statement into an equivalent Java class for us and then installed it right into the database. DB2 doesn't otherwise include an internal programming language (it is the only big database on the market that doesn't), so some Java expertise is essential when developing applications with DB2.

DB2 6.1 also provides much better interoperability than before because it includes built-in support for OLE DB, Microsoft's new database access standard (designed to replace ODBC). With this support, DB2 can connect to and access database contents (but not update data) on just about any other database. For example, using the OLE DB link we could transparently make a Microsoft

continued page 236

Preview: IBM DB2

continued from page 235

SQL Server table look like a DB2 table—very handy for shops that have more than one type of database in house.

DB2's administration tools, rewritten in Java for this release and now Web-accessible, are top-notch. Only Microsoft SQL Server has better tools and takes less work to maintain. DB2 has a detailed graphical query plan display utility, comprehensive performance-monitoring tools, and a full task scheduler for running jobs at regular times.

Although DB2's tools are better, we think you'll still need a trained database administrator to run DB2 effectively; it's not easy enough for a nonprofessional quite yet. For example, when we ran a test query that modified a lot of rows and filled up DB2's transaction log, DB2 aborted the transaction and gave us an error instead of just extending the log as Microsoft SQL Server does. It doesn't have the automatic memory tuning SQL Server does, either, and there are a huge number of server options to face when you try to reconfigure the server.

But IBM is making big usability strides with this release. For example, DB2 6.1's Index SmartGuide, similar to Microsoft SQL Server's Index Tuning Wizard, made tuning our DB2 databases much easier than in the past, letting us create the right indexes for our query workload. After we had created our test database in DB2, we submitted a number of queries and then started the Index SmartGuide. After analyzing our workload, it offered to create appropriate indexes for us.

DB2 is the only database in this roundup that provides summary tables, a major performance booster for shops that do data warehousing or a lot of end-of-month reports (summary tables are also available in Oracle8i Enterprise Edition). A summary table is a kind of scratch-pad area that a database can use to store answers to commonly asked queries.

For example, we created a table of monthly and yearly sales summaries from a table containing individual sales orders. Whenever we asked a query that needed any monthly or yearly sales totals (or any subset of our summary table, really), DB2 automatically pulled the information out of the related summary table. We saw queries on a 500,000-row table drop from taking 18 seconds to being answered as fast as we could blink.

With these new features, combined with its support for parallelism and almost complete selection of join and index types (except for bitmapped indexes), DB2 6.1 is shaping up as a top performer at a bottom-dollar price. Its administration tools are where they should be, and it offers great multimedia data handling and programmability, the two key weaknesses of Microsoft SQL Server. For organizations that can handle its somewhat higher complexity and cost, it will pay off big. (IBM Corp., Armonk, NY; 800-426-3333; *www.software.ibm.com/data/db2*.)

party application that has worked around SQL Server's limitations.

CONCLUSION

Overall, SQL Server 7.0 leaves SQL Server 6.5 in its dust and puts strong feature and price pressure on its competitors for control of the midsize-database market segment. For not a lot of money and effort, SQL Server 7.0 really delivers.

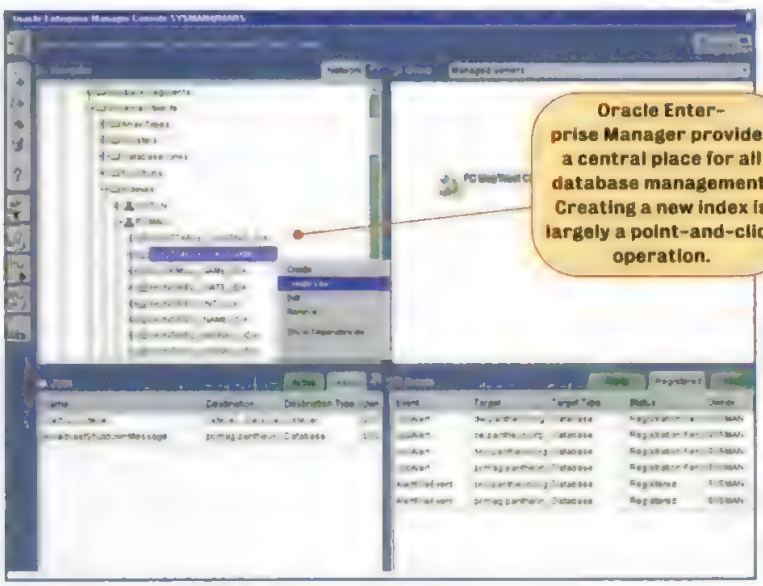
Oracle8i

Standard Edition, Windows NT version, with JServer and interMedia options: For five concurrent users, $3,925 list per CPU; each additional concurrent user, $785; each additional named user, $392.50. Redwood Shores, CA; 650-506-7000; www.oracle.com.

● Delivering the most Java- and Internet-specific features of all the databases we tested, Oracle8i is the right product for companies moving their database applications to the Web. For those that aren't moving as quickly in this direction, choosing whether to go with Oracle8i becomes a much more complex decision and boils down to how much you want to spend. Cost is really the key issue for small or medium-size businesses considering Oracle—the cost of both the software and the people trained to administer Oracle databases.

The bottom line is that Oracle8i Standard Edition, without any extra-cost options, doesn't match up to what its competitors are offering at less than half the price. If you want to get more from Oracle, you can, but have to pay plenty.

Not that Oracle as a whole doesn't have great database technology; it does, with advanced features like large-database partitioning (which helps you keep monster gigabyte-size databases under control), flexible security features, and pedal-to-the-metal speed features such as bitmapped indexes, summary tables, and parallelism. Only IBM's DB2 can really compete head to head with what Oracle offers, and then only in some of these areas. DB2 pulls ahead in other areas, like scalability: It has unmatched database-clustering technology.



None of these options are included in Oracle8i Standard Edition, though. Organizations that want to benefit from the smarts that made Oracle Corp. famous as a database company really have to get Oracle8i Enterprise Edition, which is where just about all the good stuff is. Enterprise Edition's user licenses cost a cool five times as much as Standard Edition licenses, though, so get ready for some sticker shock when asking about it.

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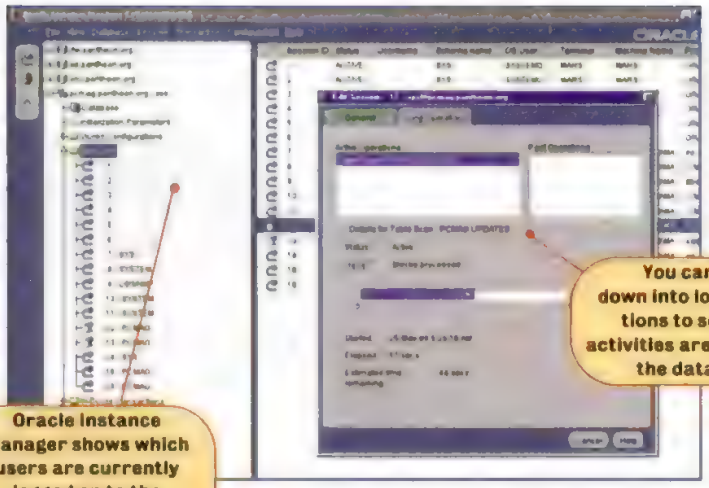
Enterprise Edition concurrent-user licenses list at $1,495 each, compared with $295 for Standard Edition (without options). Named-user licenses, where you pay for each user who has access to the database, are half as much as concurrent-user licenses for both products.

Oracle itself didn't submit a stock Oracle8i configuration for our review. The vendor included two extra-cost options: Oracle's interMedia option (multimedia data type support) and JServer (built-in implementation of Java). These choices boosted Oracle8i's scores to *excellent* for multimedia data handling and programmability on our scorecard.



JAVA EVERYWHERE

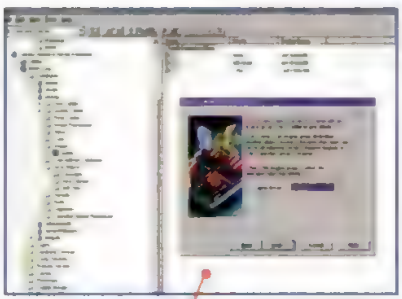
These options, particularly JServer, are the keys to what separates Oracle8i from the rest of the market. JServer brings together the capabilities of Java with those of a relational database—and does a whole lot more. Not only could we create internal database programs like stored procedures and triggers in Java, but we could also create *Enterprise JavaBeans* and run them in the server. Enterprise JavaBeans are the basic building blocks for Java-based Internet applications, and are (or will be) supported by just about every high-end Internet application server on the market (see "Build It," June 8, 1999, for reviews of several application server products).

Enterprise JavaBeans make it much easier to write Java applications that can be safely used by many people at once and that can interface easily with database contents. The company will be releasing Oracle Application Server, which should also support Enterprise JavaBeans, by late summer.

If you have JServer and OAS, you'll have a lot of design flexibility, because you'll be able to take Enterprise JavaBeans code you've developed (like a routine that does an insurance calculation or an inventory reconciliation) and drop it with hardly any changes into either the application server or the database. No other vendor has this consistent a development strategy, and the only one that is putting Java as deeply into its database as Oracle is Sybase (see the sidebar "Preview: Sybase Adaptive Server Enterprise 12.0").

Preview: Sybase Adaptive Server Enterprise 12.0

Taking direct aim at Java programmers, the forthcoming Sybase Adaptive Server Enterprise (ASE) 12.0 hits them squarely between the eyes. The server will be more Java-centric than any other database on the market and will be a good choice for companies moving to Java as their preferred programming language.



Adaptive Server Enterprise 12.0 is scheduled to ship later this year (beta 2 is scheduled to come out in July), so it will have some catching up to do to reach the early-adopter market. Sybase hasn't yet released pricing or platform information for ASE 12.0.

NOT A LEADER

In terms of its relational database features, ASE is competitive but not a leader. It supports recent database technology advances like the ability to use multiple CPUs to process a single query, and it supports row-level locking, which allows more users to access the database at once. ASE 12.0 has merge joins, a good way to join sorted information from large tables, as well as new support for SQL outer joins. This makes it easy to ask queries like "Show me a list of customers and their orders, and include customers who don't have any orders at all yet." These features were already provided by the competition.

Yet ASE still has to catch up in some important areas. It doesn't have summary tables, and it lacks the ability to do hash joins, a fast way to combine unsorted information from many large tables. DB2 and Microsoft SQL Server also provide multi-CPU support, plus all the relational engine features ASE lacks, as well as greater usability, making them better choices if Java support is not important to you.

ASE does have one very distinctive feature that only Oracle8i Enterprise Edition shares: It can prioritize queries based on who submitted them. You can limit groups of users (for example, those who run routine reports) to using only one CPU, while other users (say shop floor workers who need quick response times no matter what) could have access to all the CPUs on the machine. You could also choose to dedicate a CPU for shop-floor use only. On our tests, a reporting query mix took 5 minutes instead of 6 minutes 40 seconds when we ran it using two CPUs instead of restricting it to one.

THE JAVA DIFFERENCE

The ASE 12.0 beta 1 code we tested wasn't feature-complete, either in its server engine or in its administrative tools, but what we saw did show a lot of promise. The key difference is that besides allowing database code like stored procedures and triggers to be written in Java, ASE also allows the database structure itself, such as the way customer records are defined, to be

continued page 240

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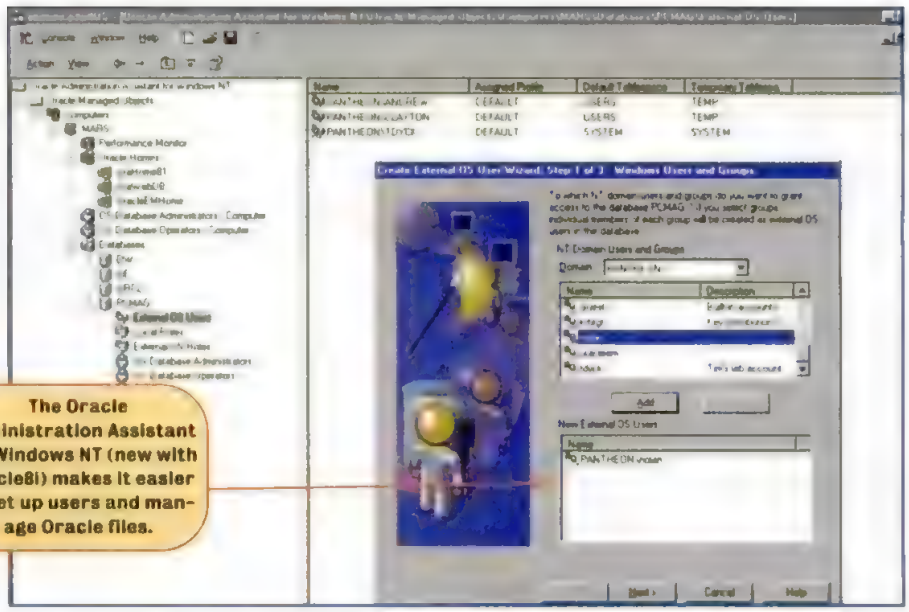
LEADING MULTIMEDIA SUPPORT

In keeping with Oracle's emphasis on having everything important to you centrally managed in its database, Oracle's interMedia option offers market-leading support for multimedia objects; only IBM does as well as Oracle at handling sound clips, pictures, video segments, and geographic information, as well as documents like resumes. Multimedia support is particularly relevant when building Web-based applications like online stores that include multimedia items such as pictures or video clips of items for sale.



The Oracle Administration Assistant for Windows NT (new with Oracle8i) makes it easier to set up users and manage Oracle files.

We had some difficulty getting images and geographic data into Oracle8i in the first place (we had to use some hand-coded scripts), but once the information was in, Oracle's interMedia libraries made classifying and searching for multimedia data easy. Later this year, Oracle is expected to release a tool called Oracle iFS, which will make an Oracle8i database look like a regular disk drive in Windows Explorer, thus letting you load multimedia data using a regular file copy command.

InterMedia's Locator module deserves special mention because it is so useful. It provides a set of functions for calculating location data, such as which customers are closest to which of your branch offices. Oracle unfortunately does not provide the conversion database to turn ZIP codes into the special geographic codes Locator needs, but this service is available from a number of Oracle's partner companies.

Oracle8i also provides market-leading support for object-oriented database designs, including complex table structures that can inherit properties and methods from other database table objects. Object designs can help avoid design errors and make databases easier to maintain.

WHAT'S IN IT FOR THE REST OF US

Keep in mind that if your organization isn't developing its own database applications but is performing its database access from packaged database query programs like Seagate Crystal Reports or from Microsoft Excel, this stellar Java and multimedia support won't mean beans to you. It's all pretty high-end stuff, but it really is the core focus of where Oracle is taking the database.

When using packaged applications, Oracle8i comes out as a pretty decent per-

Preview: Sybase

continued from page 238

created and stored as native Java objects (instead of using traditional SQL table definitions).

So what's the point of having Java objects in the database? They make developing new Java client applications much easier than they would be otherwise.

For example, we wrote a Java file defining data such as Name and Employee ID and business logic such as a tax-bracket calculation in an Employee class. After we had compiled the file and converted it into a Java JAR file, we registered it with ASE using its management application, Sybase Central. We could then create new employee objects using a modified version of the SQL "insert...values" command.

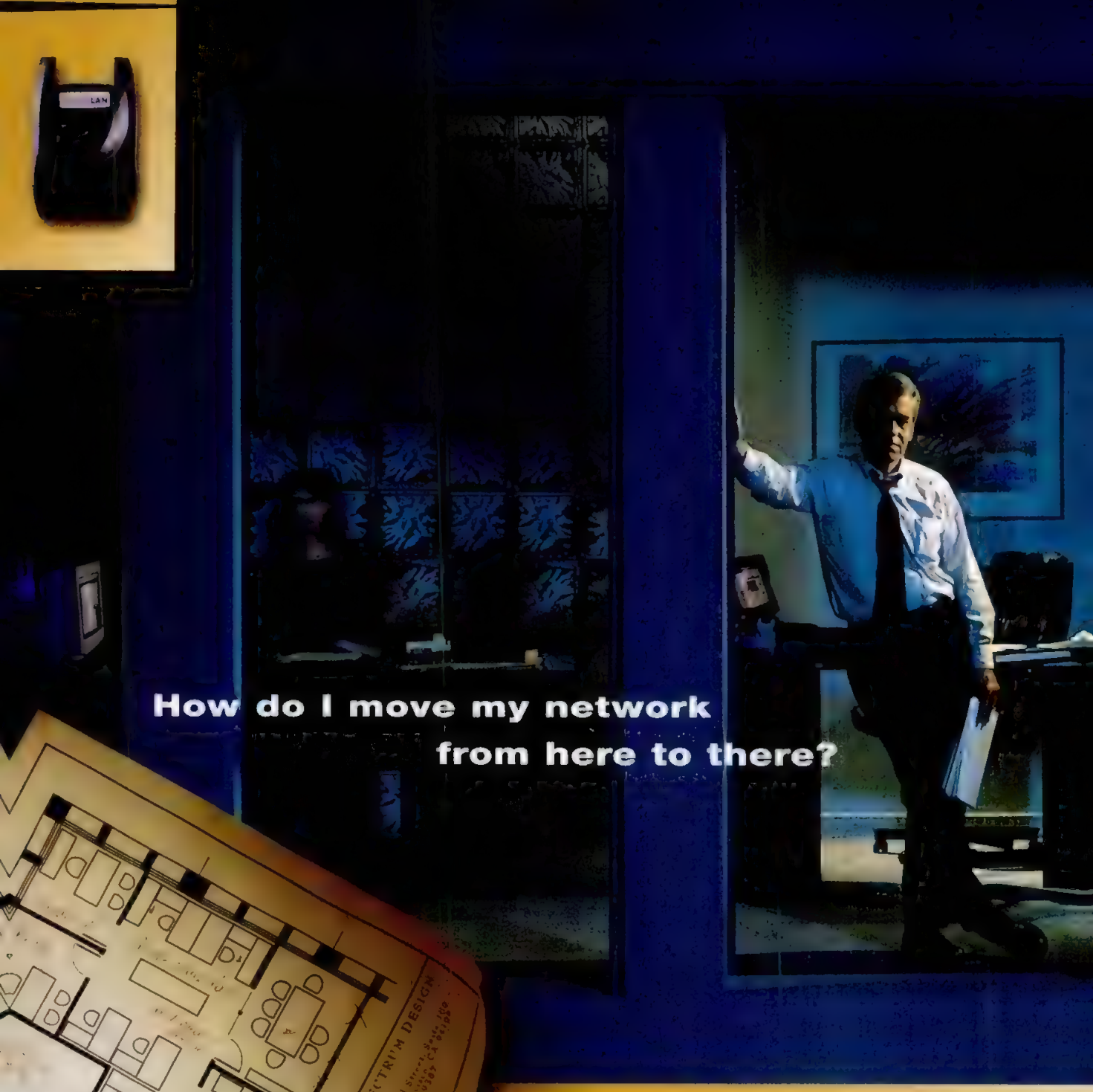
Since our Employee object was a normal Java class, accessing it from Java code was very easy: We could retrieve it with a single Java call and then work with it in its native form. To do the same thing with Oracle or DB2 takes more code and is more cumbersome, because we'd have to write extra mapping code between SQL database information and our Java variables.

ASE's Java support has its limitations, though. For example, since it requires a new query syntax, older applications will have to be rewritten to take advantage of ASE's Java features. By contrast, DB2 and Oracle both include functions that can make object-oriented data look like normal relational data. This allows you to update your database designs without having to change your client applications.

We also noticed that we couldn't retrieve Java objects in sorted order without adding some extra code to convert Java data types to SQL data types. We were able to use normal SQL commands to group Java objects into categories or retrieve only particular Java objects based on their contents (for example, selecting only employees that had salaries over $50,000).

Sybase has arranged for partner companies to develop extra-cost multimedia extensions for ASE, options that make complex text or geographic searches possible. The approach is clunky, though, because the multimedia products aren't integrated into the database's query optimizer or indexing engine. If you're going to be doing a lot of multimedia work, choose a database like DB2, Informix, or Oracle8i that's really designed for this task.

Sybase's latest offering holds some promise for companies standardizing their development around Java. But otherwise it still seems to be a step behind its competitors when measuring the state of the art for databases. (Sybase Inc., Emeryville, CA; 800-879-2273; *www.sybase.com.*)



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SQL Databases

■ = YES □ = NO

	PC MAGAZINE Editors' Choice Microsoft SQL Server 7.0	Oracle 8i Standard Edition*
List price	$1,399	$3,925 per CPU
Number of users included	5 users (named or concurrent)	5 concurrent users
Price for each additional concurrent user / named user	$127 / $127	$785 / $392.50
Server operating-system support	Windows NT, Windows 9x	Windows NT, multiple Unix flavors
Client software operating-system support	Windows NT, Windows 9x	All server platforms plus Windows 9x
Network protocols supported	AppleTalk, IPX, Named Pipes, TCP/IP, VINES IP	IPX, Named Pipes, TCP/IP
ADMINISTRATION		
Graphical tools for		
Installing the database server	■	■
Creating and managing databases/disk devices	■■	■■
Creating and managing tables/indexes	■■	■■
Creating and managing stored procedures	■	■
Creating and managing users	■	■
Creating and managing replication links	■	■
Backup and restore	■	■
Web publishing	■	■
Database diagramming	■	Optional
Submitting SQL and viewing query results	■	■
Viewing all currently executing SQL code	■	Optional
Detecting resource-intensive queries/Killing queries	■■	■■
Graphing server engine statistics	■	■
Execution plan display	■	Optional
Providing index suggestions based on a single SQL statement/on overall server usage	■■	Optional Optional
Tools have command line access	■	■
Reverse-engineer database objects/data to a SQL script	■□	■ Optional
Languages supplied for command scripting	JScript, OS commands, T-SQL, Transact-SQL, VB Script	Java, OS commands, PL/SQL, SQL*, TCL
Security audit log of administrator and user activity	□	■
Job scheduler can run jobs at certain times/when certain events happen	■■	■■
Online manual with search engine	■	■
SERVER ENGINE		
Levels of locking granularity available	Database, table, page, row	Database, table, row
Default locking level for queries	Row	Row
Readers can block writers/writers can block readers at default isolation level	□■	□□
Can use multiple CPUs on database load/within a query/to create an index	■■□	■ Optional Optional
Can use multiple CPUs on database backup and restore/on update/on delete	■□□	Optional Optional Optional
Nested loop join/Hash join/Merge join	■■■	■■■
Semi-join for star queries	■	■
B-tree index/Clustered index/Bitmap index	■■■**	■■ Optional
Cost-based/rule-based optimizer	■□	■■
Can use multiple indexes per query	■	■
Can use just the index to answer the query	■	■
Automatically maintains necessary optimizer statistics	■	■
Dynamic SQL statements parameterized and cached	■	■
Can mark tables as memory-resident	■	■
Dynamic memory resource sharing	■	□

	PC MAGAZINE Editors' Choice Microsoft SQL Server 7.0	Oracle 8i Standard Edition*
Number of CPUs supported per server	4	4
Failover server	Optional	■
Query resource consumption governor	■	■
Can assign priorities to different groups of users	□	Optional
Incremental backup/Restore to a specified point in time	■■	Optional Optional
Default disk data block size	8K	2K or 8K
Users can choose disk block size	□	■
Parallel/asynchronous (multitasking) disk operations	■■	■■
Data and log devices can grow when needed	■	■
Year 2000–certified/Euro support	■■	■■
MULTIMEDIA DATA TYPES		
Binary large object (BLOB)	■	■
Sound / video/images	□□□	■■■
Text documents, Geospatial data, Time series	■□■**	■■ Optional
INTEROPERABILITY		
Gateways to other databases	ODBC, OLE DB	Optional
Single log-on with Windows NT / LDAP / OSF DCE	■□□	■ Optional
PROGRAMMABILITY		
Stored procedures/triggers	■■	■■
Internal programming languages	Transact-SQL	Java, PL/SQL
Debugger supplied for stored procedure languages	Optional	Optional
Database client libraries supported	DB-Lib, ODBC, OLE DB	CORBA, Enterprise JavaBeans, JDBC, ODBC, Oracle Call Interface
QUERY LANGUAGE AND DATABASE DESIGN		
SQL language version supported	SQL-92 Entry Level with extensions	SQL-92 Entry Level with extensions
ANSI isolation levels supported	Read uncommitted, read committed, repeatable read, serializable, read only	Read committed, serializable, read only
Left/right/full outer joins	■■■	■■■
Declarative referential integrity	■	■
Cascade delete/Cascade update	□□	■□
Object-oriented design support/Object references (REFs)	□□	■■
BRANCH OFFICE SUPPORT		
One-way/bidirectional replication	■■	■■
Pager/e-mail notification of errors	■■	■■
Administration tools can manage a remote database	■	■
Web-based administration tools provided	□	■
Distributed transactions within database/with other vendors' databases	■■	■■
DATA WAREHOUSING AND REPORTING		
Data loader can load directly to disk pages for speed	■	■
Data transformation and cleansing tools	■	■
Can delay constraint checking during a bulk load	■	■
Provides precalculation of summary information	■**	Optional
Included OLAP server	■	Optional
Queries automatically rewritten to use summary tables	□	Optional
Summaries understand dimensional hierarchies	■**	Optional
Automatic refresh of summaries when data changes	□	Optional
Can use data sampling to speed processing	□	Optional
Top *n* queries/Top *n* percent of total queries	■■	■□
Can handle ties when ranking top rows	■	□
Cube/rollup functions	■■	■■

* Windows NT version with JServer and interMedia options. ** In OLAP Services only.

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Get Brad, Lisa, Peter and Mike to work together.
(without screwing up the site.)

Intranet **Challenge**

former, albeit with some big feature gaps. For regular database tasks, the biggest factor that sets Oracle8i apart from all the other databases we tested is Oracle's *multiversioning concurrency* system, a defining characteristic of Oracle's architecture (Inprise's database InterBase is the only other we know that has the same feature).

Multiversioning concurrency avoids making one user wait for another user to finish making changes to the database. All the other databases in our tests would sometimes make database readers wait for a database writer to finish making changes, but Oracle never does this; its readers can always read any row in the database without waiting. This feature allows Oracle8i to push through more transactions per user than other databases can, depending on how many conflicts there are between users trying to access the same information.

Oracle8i's biggest weakness in processing queries (and especially processing reports) is that the Standard Edition doesn't include the parallel query engine included with Oracle8i Enterprise Edition. Without this, each database query can only be run on one CPU instead of however many are on your server (the Standard Edition will use all the CPUs you have, but not more than one CPU per query). Being able to process long or complex queries with multiple CPUs makes a huge performance difference on multi-CPU machines, and every other database we reviewed provides intraquery parallelism as a standard feature.

TOOLS A STEP BEHIND

Oracle8i tools are Java-based and can even be run from a Web browser. They provide all the essentials for designing and setting up a database, including some advanced features like letting you selectively delegate authority to users of its Enterprise Manager administration console. This is a handy tool for branch office deployment.

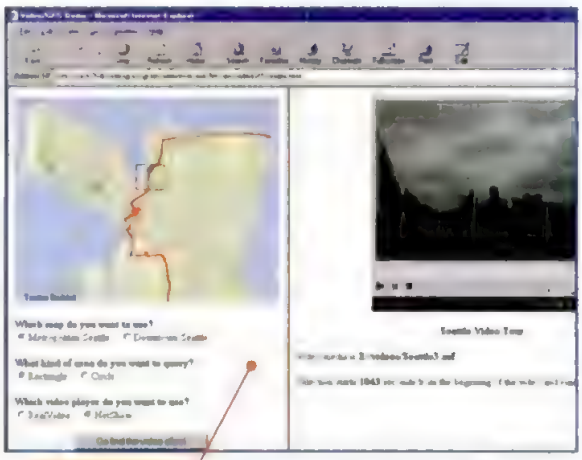
Like previous releases of Enterprise Manager, though, this one is a version behind the database, and it doesn't know a thing about new Oracle8i features such as Java stored procedures. Many essential Oracle administration tools, like its query-monitoring and database maintenance tools, are all fairly expensive separate purchases, but you'll need them to do any real work with the product.

CONCLUSION

Getting Oracle8i Standard Edition makes a lot of sense if it's going to be used with Oracle8i Enterprise Edition servers or for special purposes (for instance, for serving up Web applications), when combined with available options like JServer. Otherwise, other products offer a more complete package for a lot less money. PC

Preview: Informix's Centaur

Sometimes being first just means you have to wait longer for everyone else to catch up. That's what Informix found out in 1997. The company was one of the first of the big relational database vendors to add multimedia extensions to its database. Now that everyone from IBM to Oracle to Sybase has leaped upon that notion, Informix seeks to differentiate itself again with a big relaunch of its core database technology. It will merge its core pure relational database, Informix Dynamic Server 7.3, with its object-relational database, Informix Universal Data Option 9.1. The idea is to create a product that provides the performance of Dynamic Server on relational data with the flexibility and multimedia support of Universal Data Option.



Informix's Centaur is designed to make multimedia Web-based applications such as this one easy to build.

We couldn't get beta code to test, but we did get an early briefing from Informix officials to get the scoop on the new product, code-named "Centaur." It is targeted at customers involved in Internet development. The goal is to provide a database with a very flexible development environment, scalability to handle Internet-class loads, and the capacity to handle the new types of data the Web has made important.

Most notably, Informix has big plans to integrate Java into its database, but it is keeping most of the details secret until Centaur's official launch, around the time you're reading this issue.

Informix did note that it will distinguish its product by allowing customers to choose from a selection of standard, off-the-shelf Java virtual machines to use with its database. (IBM, Oracle, and Sybase all use specially customized Java virtual machines with their databases.) Java support will allow Informix developers to write Java-based stored procedures, user-defined routines, and DataBlades, which are what Informix calls custom extensions to the database.

This will be big step forward for Informix customers, because right now the only languages they can use for DataBlades are C and SPL, Informix's internal stored-procedure language. Centaur will also have built-in support for ActiveX objects, making it possible, for example, to write a database stored procedure in Visual Basic, as long as you're running Centaur on Windows NT.

Centaur will be a superset of Informix Dynamic Server and will use the same database format, so customers won't lose any features or have complicated upgrade procedures when making the switch. Centaur will also include all the design and programming flexibility that made Informix Universal Server such a technical achievement. It will support object-oriented database designs, custom table and index routines, and an extensible SQL query parser, so customers can add arbitrary functions to their SQL queries and not just use standard SQL functions.

Informix's Centaur looks as if it will put the company back into the database race—and provide current Informix customers with a solid growth path for the future. (Informix Software Inc., Menlo Park, CA; 800-331-1763, 650-926-6300; *www.informix.com.*)

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TUTOR

Home Network Setup

Sharing Internet access has become a prime motivator for installing home networks. Fortunately, the setup is a lot easier than it once was.

By Bruce Brown

Here's an increasingly common scenario: You finally get a cable modem or DSL to connect to the Internet in your home, and suddenly everyone in your family demands equal access. If money's no object, you can sign up for additional cable modems or DSL connections, but there's a better way to bring full-speed Web connectivity to each PC in your house: Set up a home network.

Low-priced but increasingly powerful network starter kits are making it easier than ever to network two or more PCs in your home. In this tutorial, we'll cover the basics of setting up a home network. We'll use an up-to-date home networking starter kit, a mixture of new and old PCs, and a printer.

Shared Internet access is the main reason many people network the PCs in their homes, a topic so important that modem sharing, including making the connections and setting up the software, will be the subject of a separate tutorial in an upcoming issue.

PLENTY OF ADVANTAGES

Although shared Internet access is the monster home networking motivator, other good reasons still count. Networked PCs make file sharing convenient, let you use one printer from all your networked computers, add security by facilitating backups, and provide a playground for network-enabled games. Each of the traditional reasons to network can be argued against easily, but when added to the undeniable advantages of shared Internet access, the combined force is making this a huge year for home networking.

WHICH FLAVOR? WE'LL TAKE VANILLA

We chose wired Fast Ethernet technology for our home network example. Despite a broadening selection of home networking technologies that use existing phone lines, AC power lines, or no wires at all, Fast Ethernet is still the smart choice because of its high speed, reliability, relative low cost, and the ability to add more devices easily without significant performance degradation. If you can't connect your PCs with cables conveniently (or at all), the no-*new*-wires or wireless technologies are a good choice. But as long as you can "pull cable," it behooves you to do so.

HOME NETWORK TEST CONFIGURATION

To demonstrate a home network setup, we looked to Netgear (*www.netgearinc.com*). We chose a Netgear DB104 Network Starter

More on the Web:
You'll find all of the articles, examples, and code files in this section at PC Tech online.
www.pcmag.com/pctech

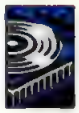
USER TO USER

Use icon dividers to keep shortcuts organized in the Quick Launch toolbar; playing WAV and MIDI sounds; a system that turns on and off periodically; print snaking columns in Microsoft Word; a batch file that backs up system files; a Microsoft Excel function that changes the definition of weekdays; eliminating blank lines in Access forms; considerations concerning your Windows swap file; add printing choices to right-click menus. *Page 253.*

UTILITIES

IconLock, this issue's free utility, lets you freeze desktop icons in the arrangement you choose, without interfering with normal Windows operation. Once you lock the layout, a password is required to change it. IconLock also lets you save and restore multiple desktop layouts and restrict the use of Explorer and context menus. *Page 261.*

PC TECH



Data reporting has become a lot easier for developers, with the appearance of a whole new generation of visual tools. But creating effective reports still requires a sound strategy. We'll take you through the process, demonstrating all the steps involved in producing your report using Seagate Crystal Reports Professional 7.0. *Page 265.*

ILLUSTRATIONS BY JEAN TUTTLE

Kit ($130 street), which includes two PCI 10/100 Fast Ethernet network interface cards (NICs), driver software, and cables, as well as the Netgear DS104 hub (see Figure 1), which automatically switches each of its four ports between 10-Mbps Ethernet and 100-Mbps Fast Ethernet, depending on the speed of the device connected. For further expansion, you can also uplink the hub to another hub.

Both cards in the kit support 100-Mbps throughput, but using a switching hub gives you the flexibility to add PCs (extra PCI NICs cost $25 each) or printers with 10-Mbps connections to your network. The dual-speed nature of the Netgear DB104 kit also means that if anyone in your household brings home a notebook PC, the physical connection should be easy. (Note that if your notebook is configured for an office network, switching to a home network at night may not be a trivial undertaking. Check with your IT support people for a configuration cheat sheet to make network switching easier.)

FIGURE 1: *The Netgear DS104 hub features status LEDs and automatically switches between 10-Mbps and 100-Mbps devices.*

We used the Netgear DB104 Network Starter Kit to set up a Windows 98 peer-to-peer network populated by a Micron Millennia 400 desktop PC, an NEC PowerMate 2166M desktop, and a Dell Inspiron notebook. To connect the notebook to the network, we used a Netgear FA 410TXC 10/100 PCMCIA card adapter ($85). After adding cards to the three PCs and connecting to the hubs, we configured each of the systems to share hard disk contents with other users on the network and print to a shared printer, an Epson Stylus Color 600, which was attached to the NEC desktop.

STEP 1: PLAN FIRST, PLAY LATER

If you plan ahead, you can save time setting up your network and making sure that it is more convenient. Assuming that you will be networking only a few computers and maybe a printer or two, decide ahead of time where the computers, printers, and hub will be located and how you'll place the cables. If you'll be sharing Internet access as well, be sure that at least one of the PCs is near a phone jack or cable or DSL drop.

If all of the PCs and peripherals will be in one room, which actually does happen fairly often in home networks, you may be able to run all the cables behind the PCs and avoid having to go under carpeting, through walls, or (worst case) between floors. If running the cables is going to be difficult, look for help from a company that installs home security systems and is experienced in getting wires into multiple locations without creating an unsightly mess.

STEP 2: GET READY TO INTERFACE

Once you've planned the layout of your home network, it's time to install the network interface cards (NICs). There are external parallel port and USB Ethernet NICs that don't require you to open the PC, but Fast Ethernet NICs are currently available only as internal adapter cards (usually using a PCI bus) or in PCMCIA (PC Card) format for use with notebook computers. There's no magic to installing an internal NIC in a PC, but be sure to ground yourself to prevent injury or damage. Seat the card firmly in an available, appropriate interface slot, and screw the card bracket into the PC case so it won't work itself loose. You should always turn off the power to your PC before removing the computer cover and inserting or extracting expansion boards. Many notebooks, however, let you insert PC Cards with the power on.

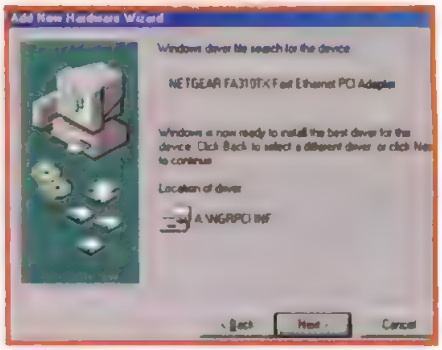
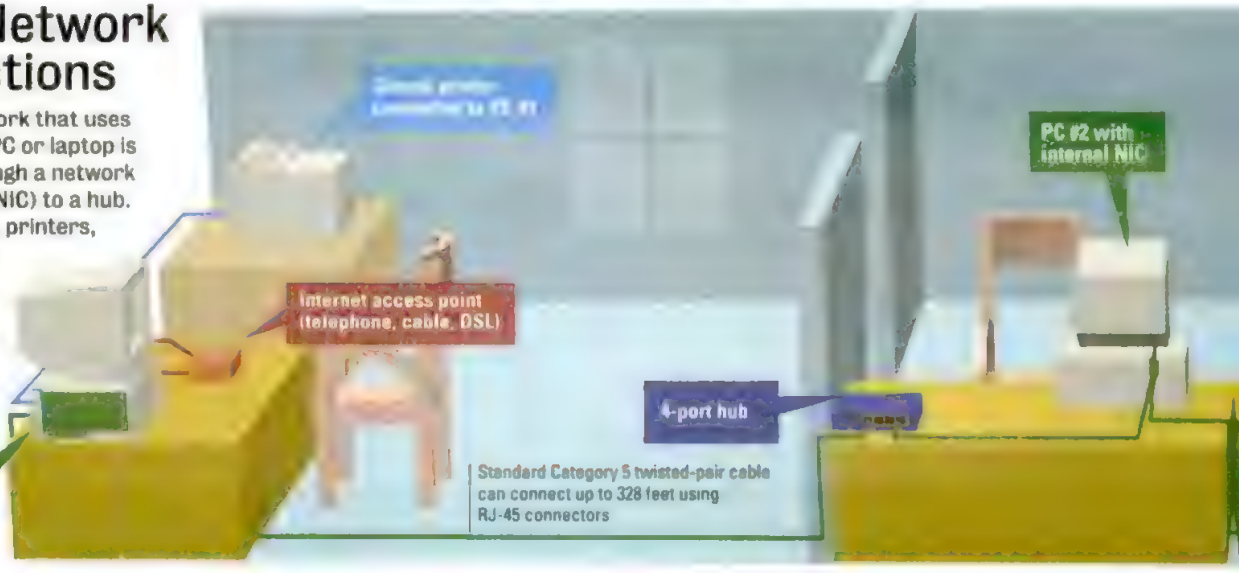


FIGURE 2: *After you install a network interface card (NIC) in a PC running Windows 98, you'll be prompted for a driver file the next time you start your computer.*

After you insert the NIC, you need to load the drivers. With desktop PCs you will likely be prompted for the driver software (usually pro-

Home Network Connections

On a home network that uses Ethernet, each PC or laptop is connected through a network interface card (NIC) to a hub. Internet access, printers, and hard disks attached to any of the PCs can be shared by any of the other PCs on the network.



vided on floppy disk) the next time you turn on the PC (see Figure 2). If you insert a new NIC into a running notebook, you'll likely be asked for the driver immediately. Most network starter kit vendors now present basic information for network setup and configuration on a foldout quick-start poster or booklet.

A likely but minor irritant in the process is that Windows 98 will ask for your operating-system disk several times during the NIC installation process, even if the same files have already been installed. You'll also be prompted to restart the computer at least once. When driver installation is complete, click on *Start | Settings | Control Panel*, and run the System app. From the *Device Manager* tab choose *Network adapters* and look for the NIC in the displayed list. If there is no red arrow or yellow exclamation point on the icon for your card, it has been correctly installed.

STEP 3: GO CONFIGURE

After a NIC has been installed, the next step is to configure your PC and the network card to communicate with your network. You start this process by clicking *Start | Settings | Control Panel | Network*, which pops up the Windows 98 Network screen. It offers three menu tabs: *Configuration*, *Identification*, and *Access Control*. You have to repeat the following tasks for each PC containing a NIC.

The *Configuration* window (see Figure 3) displays the network components that have been installed on your PC, including clients, adapters, protocols, and services. A typical configuration will list *Client for Microsoft Networks* and *Client for NetWare Networks* before a number of adapters. In addition to your NIC, other adapters will likely include a generic Windows 98 Dial-Up Adapter and possibly one or more adapters for non-TAPI compliant online services, such as an AOL Adapter.

Two protocols, IPX/SPX and TCP/IP, will also likely be installed, with a separate item for each protocol for each of the installed adapters. The last item in the list should be a service identified as *File and printer sharing for Microsoft Networks*. If the file- and printer-sharing service or any of the above clients or protocols is not installed, the next step is to install each missing item. Click on the *Add* button, select the network component type, and choose the specific component from the displayed list.

For simple peer-to-peer networking, you should not have to change any TCP/IP settings. You can check the settings by highlighting the TCP/IP protocol listing for your NIC and then clicking on the *Properties* button. Note that if you install modem-sharing software or if you are bringing home a notebook configured to run on an office network, you will most likely be making changes to these windows.

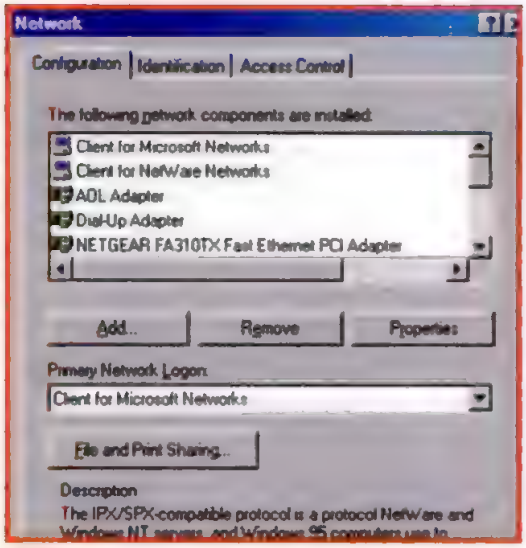


FIGURE 3: *The next step is to make sure you have selected the necessary networking clients, services, and protocols. To get to this screen, click on* Settings | Control Panel | Network. *For Windows 98 peer-to-peer networking, you don't need to assign TCP/IP addresses for each computer on your network.*

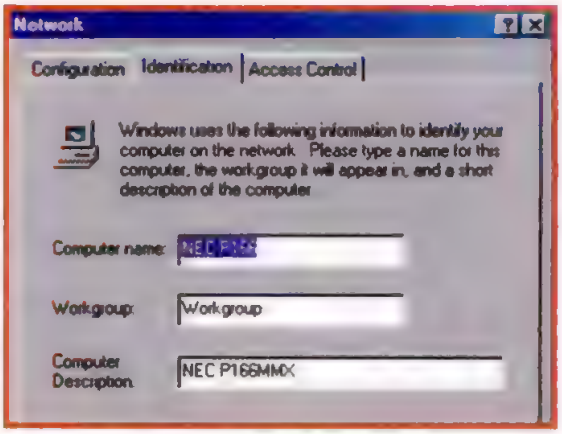


FIGURE 4: *When filling out the* Identification *page on the Network setup screens, be sure that each PC has a unique name but that all have the same workgroup name.*

Back at the Network applet's *Configuration* tab, you should click on the *File and Print Sharing* button and then check the boxes that let others access your files and use your printers. At this stage you're not actually selecting a drive or printer to share, but be aware that when you connect to the Internet with file sharing turned on, there is the potential for unauthorized access to your files. To counter this problem, modem-sharing software usually includes firewall protection preventing outsiders from accessing your shared drives.

At this stage it's likely that you've restarted your PC after software prompts at least once or twice as Windows 98 registers the new network components you've selected. Remember to keep your Windows 98 CD-ROM disk handy.

Before leaving the *Network* properties dialog, the last task required is to set your PC's identification. Click on the *Identification* tab (see Figure 4). You do not need to fill in the *Computer Description* field, but you should use a unique *Computer name* for each PC and the same *Workgroup* name for all of

FIGURE 5: *To configure hard disks for sharing on your network, right-click on the drive in the My Computer window, select* Sharing *from the context menu, name the drive, and then select the settings you prefer.*

the PCs on your network. If you don't use the same *Workgroup* name, your networked PCs won't be able to communicate.

STEP 4: MEET AT THE HUB

After the NICs are properly installed and configured, the next step is to connect each card to the network hub via a single cable. For Fast Ethernet you'll most likely use Category 5 twisted-pair cable with an RJ-45 connector (it looks like a large telephone plug). Category 3 twisted pair cabling uses the same type of connector and is less expensive than Category 5 but is rated only for regular Ethernet networks (and yes, you'll probably find it won't work at 100 Mbps). Any PC can be up to 328 feet (100 meters) from the hub, but most likely you'll use shorter cables. If you need extra cables, you can expect to pay $5 to $30 depending on the length. Buy cable from known companies, such as Belkin Components, Cables to Go, and Compucable: Quality matters a great deal, so don't buy a bargain with an unfamiliar brand name.

The hub itself doesn't require software or configuration, but it does need to be powered by an AC adapter. The only change you might make to a hub is if you connect it (now or later) to another hub, in which case you may need to flip a switch that converts one of the normal PC ports on the hub to an uplink port. Some hubs have a separate, special-purpose uplink port.

When you connect PC network cards to a hub, assuming everything is powered on, indicator lights will show the connection and often, as with the Netgear hub, indicate the maximum connection speed (either 10 Mbps or 100 Mbps). Other lights may indicate link integrity and activity for each connection. The Netgear hub adds a series of lights that display overall network bandwidth utilization.

STEP 5: SHARING THE GOODS

After you've installed the NICs, configured your network settings, and connected the PCs to your hub, the last step in setting up a basic home network is to select drives and printers to share on the network. Note that if you did not enable *File and Print Sharing* in the Network applet on any PC on your network, you will not be able to share drives in or printers attached to that PC.

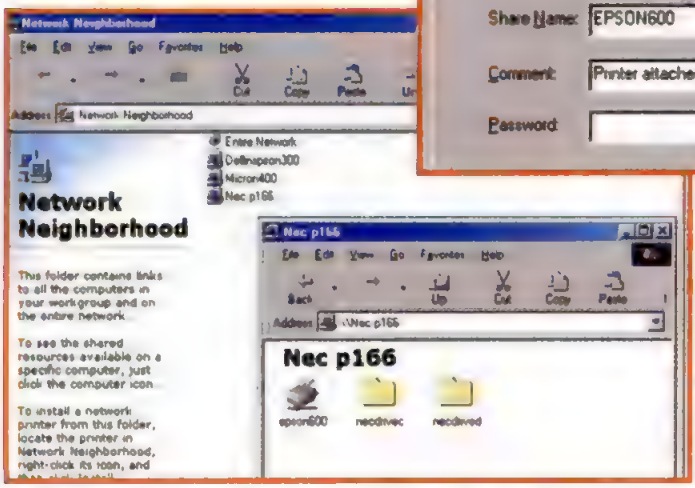
To share a drive or a folder on a drive, right-click on the drive or folder in the *My Computer* window or as it appears in Windows Explorer. Select *Sharing...* and enter a name that's unique on that computer (see Figure 5). For example, three PCs on a network could each have a shared drive identified as DriveC. Descriptive names are a lot more helpful when searching on a network; for example, BillsDellC is more helpful than plain DriveC.

After naming a drive or folder, you can select the type of access you want to grant users on the network (read-only, full, or password-dependent), and you can assign passwords. After you click *Apply* or *OK*, the drive or folder will shortly be available to users on your network. To access files in a shared drive or folder from another computer, you can click on Network Neighborhood either from the Windows Desktop or in Windows Explorer. A list of computers currently installed and running on your network will appear (see Figure 6). Through these you can select, open, copy, move, and delete files and folders on shared drives just as if the data were on your own PC.

To share a printer, you first open My Computer or click on *Start | Settings | Printers* and then right-click on the printer and select *Sharing* (see Figure 7). Select *Shared As*, name the printer, and click *Apply* or *OK* to complete the process. You can't immediately print on a shared printer from a networked PC, however; first the desired printer must be installed on each PC that will use it, a task made relatively easy with the Windows Printer Wizard. Select *Start | Settings | Printers* and click on the *Add Printers* button to start the wizard. When you are prompted for the method of printer attachment, select *Network printer* and click on *Browse* in the next screen to choose from the printers defined as shared on your network.

In most cases, the required printer drivers will copy to the remote PC to complete installation, although some printers, particularly those that use monitoring software, may require you to run the original printer software on your PC to complete the process. After a printer is marked for sharing and installed on a network PC, someone using that PC can choose the printer, and even set it as the default printer.

FIGURE 6: *When your network is all set, click on Network Neighborhood on the Windows 98 Desktop. Click on any one of the connected computers to see a list of all the computers on the network. Click on one of the networked computers for details on shared drives and printers.*



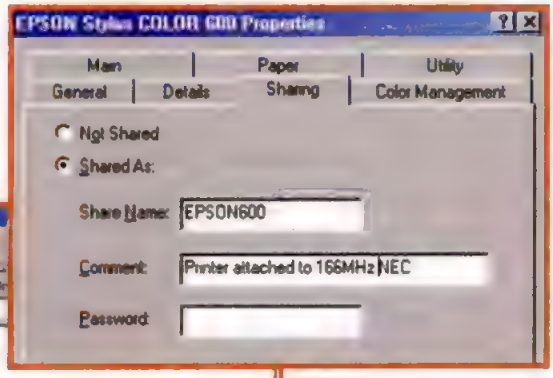


FIGURE 7: *You can share a printer attached to any of the computers on your network. The first step is to turn on the sharing option. The second step, not shown, is to use the Add Printer wizard found in the* Start | Settings | Printers *window.*

THE END RESULT

When your network installation and configuration tasks are complete and the cables securely connected, you're finally ready to share files, play network games, use all the printers on the network for the jobs for which each is best suited, install modem-sharing software, and even protect your data by copying vital files to PCs on the network.

Network setup still isn't simple, but it's much easier than in previous years. The good news is that although installing and configuring the first NIC may take from 30 minutes to an hour if you're extremely thorough and insist on checking everything, once you gain confidence, installing another NIC will take you just a few minutes. PC

Bruce Brown is a contributing editor of PC Magazine.

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IT'S EASY TO SPOT A NOTEBOOK PC WITH INSUFFICIENT MEMORY. You spend too much time staring at the hourglass and too little time getting things done. That's because insufficient memory forces your notebook to create a "virtual" memory file on your hard drive that slows performance to a crawl. Fortunately, there's a simple cure: more Kingston® memory. Adding memory can double the life of your notebook for a fraction of the cost of buying a new one. Why Kingston? Because Kingston tests every cell on every chip on every module—on a 128MB module that's over a billion cells. And each module is backed by a lifetime warranty. How's that for a safety net? To find out how much Kingston notebook memory can save you, just call (800) 337-8420. Or visit our Web site at www.kingston.com.

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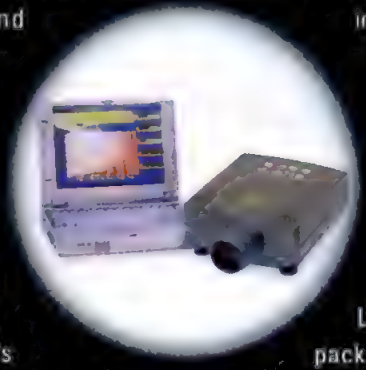

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SOLUTIONS

USER TO USER

Sound Through the CD-ROM Drive

My computer does not have a sound card, but it does have a CD-ROM drive with a stereo headset jack on the front. Is there any way I can get WAV or MIDI files to play so that I can hear them through this jack?

Fernando Donato
São Paulo, Brazil

PC Unfortunately, you'll need to add a sound card before you'll be able to hear those sounds.

The headset jack on your CD-ROM drive is there only to play sounds from audio CDs. The drive has the built-in circuitry to decode the digital data from these disks and convert it into the analog signals needed by speakers or headphones.

The drive does not contain any circuitry to convert digital information from WAV or MIDI files, nor does it have any way to receive that data from your computer. WAV files are digitized sound files that use a format similar but not identical to the data on audio CDs; many WAV files use some form of compression to save storage space. MIDI files are more like computer programs: They are a series of instructions that a synthesizer uses to produce sounds. You'll need a sound card to translate either of these types of files into sounds that you can hear on a speaker or headset.

The good news is that you can probably add a sound card to your system for a modest price. A simple card costs less than $15, and one with more advanced features can be had for less than $30.—*Alfred Poor*

Quick Launch Icon Dividers

The *Quick Launch* toolbar doesn't give you a way to use icon dividers to keep shortcuts organized, but it's easy to remedy this. Find an icon you want to use as a divider, or make your own by creating a small bitmap file and naming it with an .ico extension. Then open Notepad and enter

```
[Shell]
IconFile=IconName.ico
```

where `IconName` is the name of your divider icon. Save this file in your Quick Launch folder (usually C:\Windows\Application Data\Microsoft\Quick Launch) as, say, Divider1.scf. You now have a button that can be used to separate icons in the *Quick Launch* toolbar.

Michael Herman
Highland Park, New Jersey

PC The *Quick Launch* toolbar is a feature of the Windows Desktop Update, installed along with IE4 and Windows 98. Microsoft apparently expected that users would organize these icons by creating multiple toolbars to hold them. To do that, you would right-click on the taskbar, choose *Toolbars* from the pop-up menu, select *New Toolbar...*, and identify a folder that will hold the shortcuts for your new toolbar. Some users, however, will prefer a single toolbar with dividers, as described here.

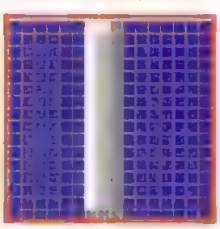

FIGURE 1: *When you create a bitmap to be used as an icon, Windows will treat all pixels matching the color in the top left pixel as transparent.*

To create the bitmap for your divider, launch the Paint accessory. Select *Attributes* from the *Image* menu and select *16 x 16 pels* or *pixels* as the image size. Select *View | Zoom | Custom...*, click on the *800%* radio button, and click on *OK*. Before you draw the image, click on *Save*, choose *16 Color Bitmap* in the *Save as type* list, and save it under whatever name you choose. That way, if you accidentally use a color that's not available in the 16-color palette, it will display using the nearest color that is available.

When using a bitmap in place of an icon, Windows treats the color in the bitmap's top left pixel as transparent. Any areas of the image matching that color will let the background show through. Your first step is to choose a color that won't be used in the icon image and fill the whole area with it. Draw your divider, being sure not to change the color of the top left pixel. Figure 1 shows an expanded view of a divider bitmap—the dark blue areas will be transparent. After saving the bitmap, rename it with an .ico extension.

FIGURE 2: *The divider icon (shown in the center of this picture) can serve to separate groups of Quick Launch icons.*

Now choose *Find Files or Folders...* from the *Start* menu's *Find...* item and enter `"Quick Launch"` (including the quotes) in the search field. It will probably find just one folder, but if there are more returned, choose the one that's most similar to C:\Windows\Application Data\Microsoft\Internet Explorer\Quick Launch. Double-click on the folder to open it in Windows Explorer. Right-click on a vacant area in the Explorer display, choose *New* from the pop-up menu, and choose *Text Document*. Double-click on the new document to launch Notepad, and enter the text shown in the reader's letter above. You'll need to use the full pathname of the ICO file on the `IconFile=` line, unless the icon resides in the Windows directory. Save the file, close Notepad, and return to Explorer. Rename the file so it has the filename of your choice and the extension .scf. Answer *Yes* when Explorer asks if you're sure you want to change the extension. Your new icon separator should appear right away in the *Quick Launch* toolbar; drag it into place and you're done (Figure 2). If you want multiple dividers, simply make multiple copies of the SCF file.

You may be wondering what else an SCF file can do. The file type is named Windows Explorer Command, and a standard installation will include three such files: Explorer.scf, Show Desktop.scf, and View Channels.scf. All three have roughly the same layout. Explorer.scf looks like this:

```
[Shell]
Command=2
IconFile=explorer.exe,1
[Taskbar]
Command=Explorer
```

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It's clear that we can change the icon by editing the `IconFile =` setting, but unfortunately there's no documentation to clarify the full range of capabilities for these files. What other settings are possible? What values can the different settings take? If you make any significant discoveries about SCF files, be sure to tell us about them!— *Neil J. Rubenking*

On Again, Off Again

My Pentium/133 system shuts down and restarts itself quite frequently. As far as I can tell, it doesn't seem to matter what I'm doing at the time. What could be causing this, and how can I fix it?

Aurele Dumont
via the Internet

PC This problem could be caused by any of a long list of factors, but three suspects rise to the top: heat, a loose connection, or power problems.

The top candidate is that you have a component that is overheating; the most likely suspect is your CPU. Make sure you have a high-quality cooling fan on your processor, and that it is working. A replacement cooling fan costs $20 or less, so it's not an expensive item to replace or add.

The next factor to consider is a loose connection somewhere in your system. Disconnect and reseat the power cables from the power supply that attach to the motherboard. If you have a voltmeter, you may want to check for loose wires in the connectors while you have them disconnected. If this doesn't resolve the problem, you may have a cracked trace on the motherboard or a poor solder connection; a motherboard replacement may be the most time-efficient and cost-effective solution at this point.

The remaining prime suspect is a problem with your electrical power. Surges or power interruptions may cause your system to reset, but you would probably notice these events in other devices such as lights or other electronics. Still, adding a high-quality surge suppressor or standby power supply between the computer and the electrical outlet may resolve the problem.— *Alfred Poor*

Print Snaking Excel Columns in Word

I recently ran into a problem printing data from Microsoft Excel 97, which I solved by printing from Microsoft Word 97 instead. I had a spreadsheet with over 1,000 rows but just two narrow columns. I wanted to print it out in snaking columns—starting at the upper-left-hand corner of the page, going down to the bottom, then going back up to the top of the page, moving to the right of the first column, continuing to the bottom, and so on.

To accomplish this trick, first use Excel to save the worksheet as a text file with the *File / Save As* command, setting the *Save as type* to Text (Tab-delimited). Next, go to Word and load the file. Each row will show up in Word as a single line with a paragraph return at the end and a tab between the text (or numbers) from each cell. The tabs ensure that the text shows up visually as two distinct tabbed columns within the one column of text along the left side of the page.

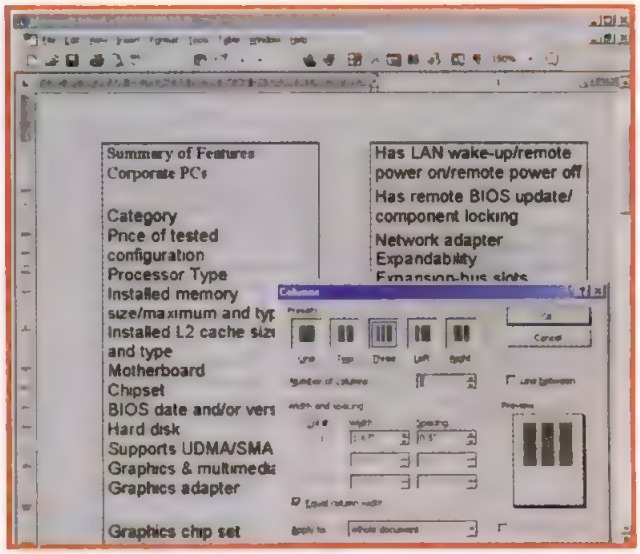

FIGURE 3: *After opening an Excel workbook file in Word, you can invoke the Columns dialog to snake sheets with a lot of rows onto one page.*

Converting the single column of text to snaking columns in Word is simple. Select the entire file with Ctrl-5 (that's 5 on the numeric keypad), choose *Format / Columns* (see Figure 3), set the number of columns to two, three, or more as appropriate, and choose *OK*. You may also want to check the *Line between* box to add a line between the snaking columns. You can also experiment with the number of columns to find how many will fit across the page. Simply give the *Format / Column* command each time, and change the number of columns to use.

One shortcoming of this approach is that it will work with only one worksheet at a time. If you have data in more than one worksheet, you'll have to save each separately, and then import each one after the first into Word with the *Insert / File* command. By using Word, however, you gain all the formatting features Word has that are missing from Excel.

Jack Cobb
Chicago

PC The basic idea of using Word as a report generator for Excel is a good one, and the approach described in this tip will work. But saving the Excel worksheet to a text file and then opening the text file in Word is not the easiest way to move data to Word. Among other problems with this approach, you'll lose much of your formatting—including font face, size, and style—when you save the file in text format, so you'll have to reformat the text after you open it in Word. You'll also find that if the number of characters in the first column differs from one row to the next, the columns may overlap in Word, so that you have to adjust the tabs.

A far easier way to use Word as a report generator for Excel is simply to open the worksheet file from Word. This will not only retain such formatting as font, size, and style, it will also convert the worksheet into a Word table, wrap long entries in the appropriate cells, and maintain your columns and the worksheet grid. (You can, of course, use Word's *Format | Borders and Shading* command to adjust whether the borders on the grid print.)

Even better, if the Excel file has more than one worksheet, opening it with Word lets you skip the additional steps of saving and loading each worksheet separately. To open an Excel file in Word, choose *File | Open*, set the *Files of type* to *All Files* or *Microsoft Excel Worksheet*, select the file, and choose *OK*. Word will respond with its *Open Worksheet* dialog box and let you choose to open the *Entire Workbook* or any one sheet. If you choose *Entire Workbook*, Word will load all of the worksheets at once, putting them all in one file, one after another.

Once you've opened a file, with the worksheet data converted to a Word table, you can transform it into snaking columns using the same steps as you would if you had first saved as a text file and then opened your document in Word. In fact, you can wind up with the same result from either route, but it will be much less work if you simply open the Excel file with Word.—*M. David Stone*

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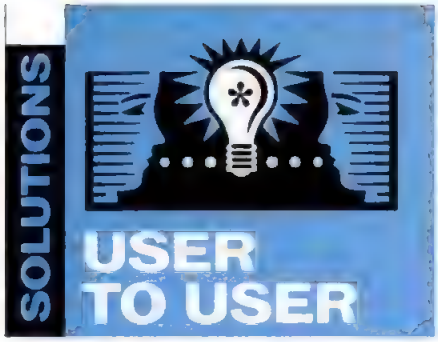

Batch File Backup

I want to create a batch file that will make backups of my system files to a directory I call C:/Backup, so I have an easy way to save them before I install new software. The problem is that I can't seem to copy User.dat and System.dat files. I tried using `attrib` before the copy line, but I still can't get it to work. Can you help?

Wendy McLean
Hamilton, Ontario

PC In Windows 95, the best command for this job is `xcopy`, with the right switches. A statement like this will work:

```
XCOPY /H/I/K/Y user.dat
c:\backup\user.bak
```

The switches used are

`/H`	Copies hidden and system files also.
`/I`	Does not ask whether destination is file or directory.
`/K`	Copies attributes along with file.
`/Y`	Overwrites existing files without prompting.

This command will copy User.dat to the backup folder, retaining the read-only, hidden, and system attributes in the copy and overwriting the previous backup.

Windows 98 includes Scanreg.exe, which scans the Registry for errors and automatically backs it up. In a standard installation, Scanreg.exe runs automatically each time Windows starts, but you can also launch it manually. If the Registry has already been backed up earlier the same day, it will ask whether or not to overwrite the earlier backup.—*Neil J. Rubenking*

Change Excel's Weekdays

I need to use Microsoft Excel to calculate the time (in man-hours) required to complete certain monthly projects. I have recorded the start and end dates of each of the completed projects. Weekdays count as 7.5 hours of working time, while Saturdays and the days before holidays count as only 4.5 man-hours. Holidays and Sundays need to be excluded from the computation. I have tried to use the `NETWORKDAYS` function, but Saturdays (which together with Sundays are the default weekend days) are excluded from the results.

I have three questions. First, which Excel functions can I use to have the Saturdays included? I notice that Lotus 1-2-3's `@NETWORKDAYS` lets me specify which days are to be considered weekends, but Excel's function does not. Second, how do I include the eves of holidays in my calculation? Finally, how do I convert working days into man-hours—7.5 for weekdays and 4.5 for Saturdays and holiday eves?

Janet Jin-Ling
Singapore

PC Ms. Jin-Ling is right about the limitations of Excel's `NETWORKDAYS` function. Unlike its counterpart in 1-2-3, the Excel function permits no arguments about the definition of a weekend. But since neither Excel's nor 1-2-3's function gives special treatment to the days immediately before holidays, a custom function is required in any case. You can download a function that does this in Excel from our Web site, *www.pcmag.com*. Click on *Downloads*, then *Issue Archives*, and look for the file Manhours.xls in this issue's archive.

The function requires three arguments—a starting date, an ending date, and a range that lists holidays. For editing convenience, the man-hour values for weekdays, Saturdays, and holiday eves are defined as constants at the top of the function. Our function makes use of one of Excel's built-in functions, `WEEKDAYS`. `WEEKDAYS` returns a number between 1 and 7, with Sunday getting a 1 and Saturday getting a 7.

The function loops through each day from the start date to the end date, checking first to see whether the day is either a holiday or the day before a holiday. Then, for any day not falling into either of those categories, a Select Case structure gets the weekday number of the current date and increments the man-hour total by the appropriate amount.—*Craig Stinson*

Eliminating Blank Lines in Access

Using Microsoft Access, I am trying to create a directory of agencies in my area. A typical entry contains the agency name, address, city, state, ZIP code, phone number, hours of operation, and area served. But some don't have, for instance, an address. I want the report set up like this:

Agency Name Hours Area Served
Address
City State ZIP
Phone Number

Currently, if an agency lists only its name and telephone number, I have a gap where the other information would normally be. Is there a way to close up that empty space?

Dychell Edwards
Winchester, Virginia

PC You can remove the empty lines by setting the `Can Shrink` property for each text box to `Yes`, but in order for this to work, you must be sure the text boxes do not overlap. The `Can Shrink` property tells Access to shrink the control when no data is present, removing the empty space. The entire line must be empty, however. That means if you have three controls on a line, all three must be empty for Access to remove the space automatically. It also means that if a fixed object such as a graphic overlaps the line, Access won't close up the space. Instead, you may be able to do this yourself using the `MakeLines` function discussed below.

For a line to be removed, it must be totally empty. That causes a problem when, for example, a comma or other separating character remains on a line. In this case you must detect that a line has no data and prevent the insertion of unnecessary separating characters. You can do this by using the `IIf` (Immediate If) function. For example, consider the following Control Source for a text box:

```
=Trim([City] &
IIf(IsNull([Region]) Or [Region]="",
", ", ", " & [Region] & ", ") &
[PostalCode])
```

```
Public Function MakeLines(ParamArray varLines())
Dim intX As Integer, strReturn As String
For intX = 0 To UBound(varLines)
 If Not IsNull(varLines(intX)) And varLines(intX)
<> "" Then
  strReturn = strReturn & varLines(intX) & vbCrLf
 End If
Next
MakeLines = strReturn
End Function
```

FIGURE 4 *Use the MakeLines function to create a multiline control source for a text box. It closes up empty lines on a report when Access's Can Shrink method won't work.*

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This text box formats the City, Region and PostalCode on one line. If the Region data is present, a comma and a space are inserted before the Region for proper formatting, and a space appended after. If the Region data is not present, however, only a space is inserted after the City. The `IIf` function inserts a comma only when one is needed, and thus ensures a blank line when all three fields have no data.

This technique won't be useful when a fixed object such as a graphic overlaps the line, because then there's no way the entire line can ever be empty. In that case, you can't rely on the `Can Shrink` property, but you may be able to close up the lines yourself. To do so, use one text box for the entire block of lines and let the `MakeLines` user-defined function construct the lines. For example, consider the following control source for a text box:

```
=Trim(MakeLines([Address],
[City] &
IIf(IsNull([Region]) Or [Region]="",
" ", ", " & [Region] & " ") &
[PostalCode],
[Country]))
```

The `MakeLines` function automatically constructs a line for each of its arguments, but it ignores empty or null arguments. In so doing it automatically closes up the empty space. For example, if there is no Address, then no Address line is created and the following lines (City-Region-PostalCode and Country) automatically move up one line.

You can download a sample database containing the `MakeLines` function and two sample reports from PC Magazine Online (at *www.pcmag.com*). Click on *Downloads* and look for the database named Eliminating Blanks.Mdb in this issue's archive file. —*Sal Ricciardi*

The Windows Swap File

I recently found two files with the same name, Win386.swp, on my computer. They occupy about 26MB of disk space. I tried to delete them, but access was denied. What are these files? Is it okay to delete them?

Sunny Wul
Sugar Land, Texas

PC Win386.swp is the *swap file* used by Windows 95 or Windows 98 to provide your system with *virtual memory*. When Windows runs out of physical RAM, it swaps the least recently used memory areas to disk and re-uses the freed RAM. If a program requests data that was swapped out, Windows swaps it back into RAM. This allows the system to function as if it had more memory than the installed physical RAM. Some programs use the swap file even when physical RAM is available. You can't delete it while Windows is running—the system won't let you—and if you delete it after restarting in MS-DOS mode, Windows will just re-create it at startup. (This tells you how to get rid of your extra swap file: Restart in MS-DOS mode, delete both swap files, and then restart Windows. Only the active swap file should be re-created.)

> If you have another drive with more free space available, you can direct Windows to put the swap file on that drive instead.

The swap file is essential to proper operation of Windows, but it doesn't have to reside in the default location. If you have another drive with more free space available, you can direct Windows to put the swap file on that drive instead. Right-click *My Computer* and choose *Properties* from the pop-up menu. Click the *Performance* tab in the resulting dialog, and click the *Virtual Memory...* button on that tab. Check the option button that says *Let me specify my own virtual memory settings,* and choose from the pull-down list of hard disks. Don't change the Minimum or Maximum settings, and definitely don't check the *Disable virtual memory* box.

When you click *OK*, you'll see an alarming message warning that trouble could result from specifying your own virtual memory settings. Don't worry; simply changing the location of the file shouldn't cause any problems. Go ahead and restart the system. Your swap file is now on the other drive.

If you'd like to track the system's swap file usage, click *Start* | *Programs* | *Accessories* | *System Tools* | *System Monitor*. If *System Monitor* isn't present in the *System Tools* menu you will have to install it, using the *Windows setup* tab of the Add/Remove Programs applet in Control Panel.

In *System Monitor,* click *Edit* | *Add Item*. Choose the Memory Manager group, and within it choose *Swapfile size* and *Swapfile in use*. Check *Line charts* on the *View* menu. Choose *Chart...* from the *Options* menu to set the monitor's update interval anywhere from once a second to once an hour. Now launch and use a variety of programs and you can monitor the effect on the size of the swap file and the amount of memory that's in use. —*Neil J. Rubenking*

Print Directory Lists

One of the commands in your September 1, 1998, Solutions article "New Commands on Right-Click Menu for Folders" is great for DOS printers, but not for the newer Windows-only printers, such as the Canon L6000 or the HP 3100, that don't understand DOS. What can you suggest for these machines?

Gordon Raney
Novato, California

PC That article shows how to add several handy items to the right-click menu for folders, including one that will print a list of all files in the folder and another to print a list of all files in *and below* the folder. As this reader notes, some modern printers won't accept input through the old DOS `PRN:` device.

The solution is to use two files, Prndir.bat and Prndir.reg, both of which are available at *www.pcmag.com*. Prindir.bat saves directory or directory tree information to a temporary file, then prints it using WordPad. Edit this batch file to reflect the actual location of Wordpad.exe on your system, if necessary, and save it in your Windows folder. The Registration Entries file, Prndir.reg, installs the Print directory and Print directory tree commands. If your Windows folder is not C:\Windows, you'll need to edit the four command lines to reflect the name of the actual Windows folder. Remember that each backslash in the path must be represented by a double backslash.

After saving Prndir.reg to disk, double-click on it in Windows Explorer. You'll get a message indicating that its information was successfully entered into the Registry. Right-click on a folder in Explorer and choose *Print directory* from the context menu. WordPad will flash on the screen briefly as it prints the file. If you'd prefer to examine the file in WordPad instead of just printing it, simply delete the `/p` switch from the last line of Prndir.bat.—*Neil J. Rubenking* PC

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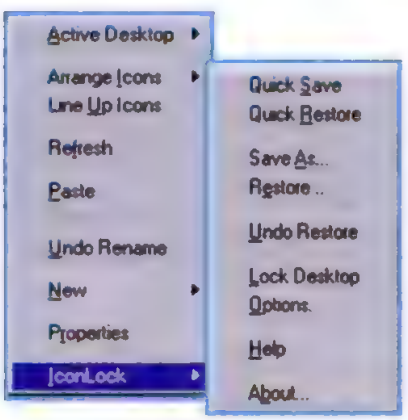
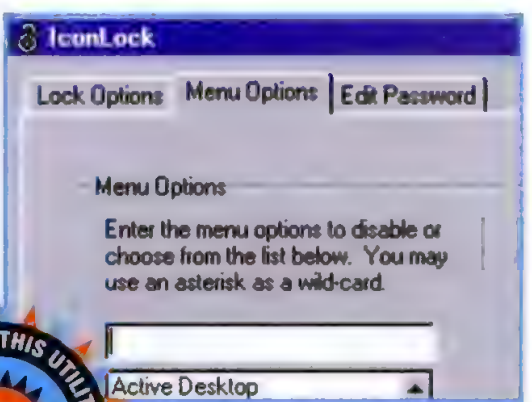
Tired of people adding, deleting, renaming, and rearranging the icons on your Windows Desktop? Perhaps you're responsible for the computers in a school, computer lab, or store. Or maybe you share a home computer with your kids. **IconLock** lets you freeze desktop icons in the arrangement you choose without interfering with normal Windows operations. It also lets you quickly save and restore different desktop layouts.

IconLock runs under Windows 95, 98, and NT 4. Some features require Active Desktop to be installed. Under Windows NT, some features require Internet Explorer 5 to be installed. An article about how to use IconLock and how it was written is available on our Web site at *www.pcmag.com/utilities*. A link to download the utility and its source code can also be found there.

Mark Sweeney, the author of IconLock, is a developer based in Amherst, New Hampshire. Sheryl Canter is the editor of the Utilities column and a contributing editor of PC Magazine.

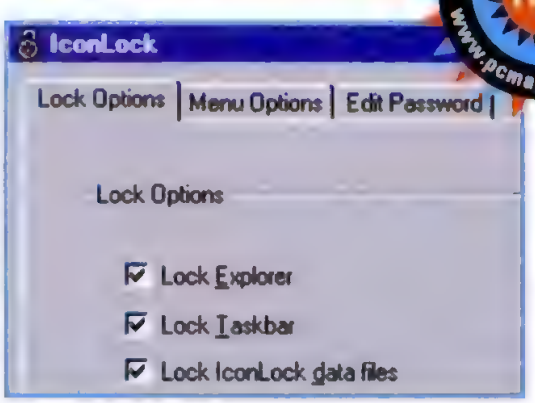


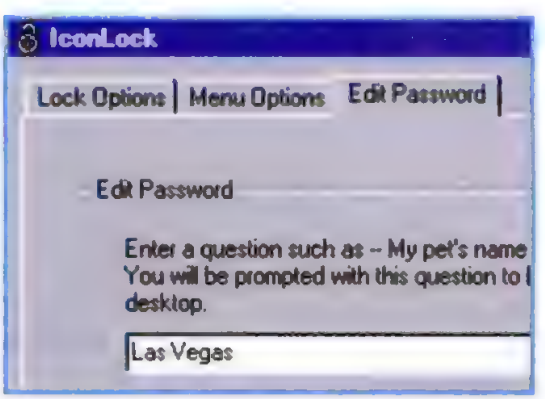
IconLock's menu options let you save and restore icon arrangements, lock and unlock the desktop, and access the Options *dialog.*



The Menu Options *page of the* Options *dialog lets you tell IconLock which context menu items to disable when the desktop is locked.*

Selecting Lock Explorer *prevents modification of the Desktop using Explorer.* Lock Taskbar *hides Start menu items. And* Lock IconLock data files *prevents tampering with passwords.*





The Edit Password *page of the* Options *dialog lets you set a password and add a hint for remembering it.*

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Data Reporting Made Easy

By Steven E. Sipe

Conveying information is a key requirement for many applications in today's market. This is true for applications as simple as a CD catalog program or as complex as a hospital information system. Moreover, users are no longer satisfied with yesterday's text-only reports, having come to expect attractive reports that include visually appealing elements such as charts, images, and decorative fonts. Luckily, the considerable effort developers once devoted to writing code to format, display, and print data is no longer necessary: A whole new generation of visual tools has emerged to assist in the creation of these graphical reports. Although each differs in features and capabilities, they're generally structured around two major components: a *report designer* that lets you visually create reports and a *print/view engine* that you incorporate into your applications for printing or viewing the reports.

Developers use report designers to create reports they can distribute with their applications, but it's important to note that though reports created with a designer can be freely distributed, the report designer generally can't. This means that if your customers wish to modify or enhance the reports you provide, they'll need to purchase their own copy of the designer.

Because reports are stored in a proprietary file format that is dependent on the designer used, your application needs a mechanism for reading and displaying them. The print/view engine, typically an ActiveX control or DLL you can incorporate directly into your application, serves this purpose. Print/view engines, unlike their corresponding report designers, may be distributed royalty-free with your applications.

Although these modern tools let you design reports with far less effort than code-based approaches, creating good reports still requires plenty of thought. To help get you started, we'll take you through the steps involved in creating reports and incorporating them into an application using Seagate Crystal Reports Professional 7.0. Although there are many good report-design packages available, we chose Crystal Reports because it provides the most complete set of reporting capabilities for typical application developers. It's also a mature product that manages to incorporate a wealth of features while maintaining ease of use and good performance.

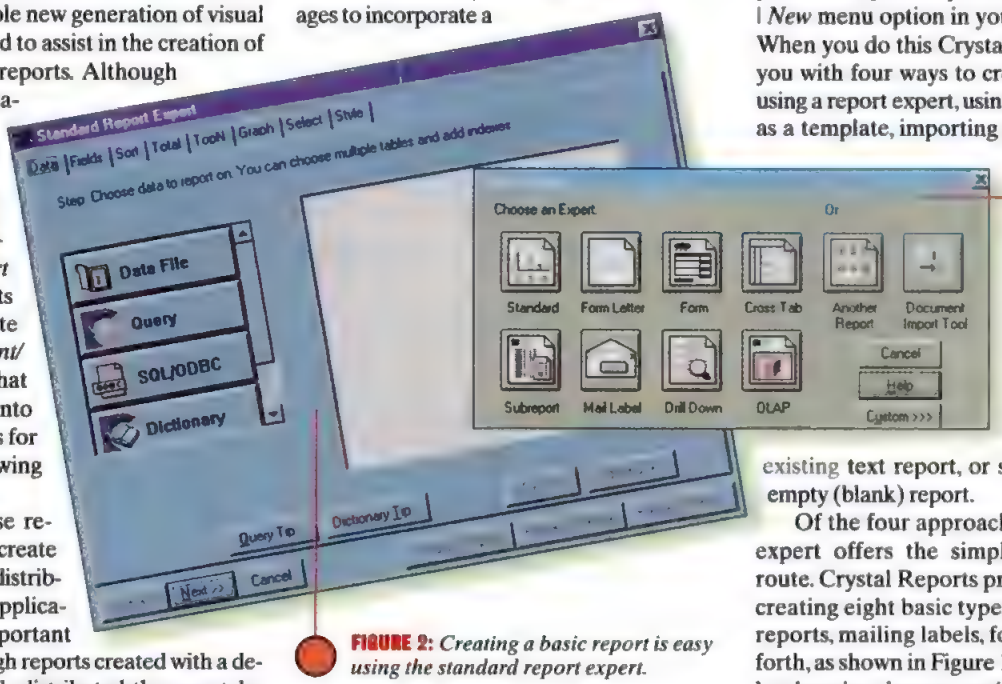

FIGURE 2: *Creating a basic report is easy using the standard report expert.*

PLAN AHEAD

This almost goes without saying, but as with most development tasks, planning plays a key role in successfully designing reports. Before you begin, consider both the report's contents and its intended audience. For example, reports used by a company's finance group will probably contain more detailed financial information than reports used by the sales group. This does not necessarily mean you have to design separate reports for each group, but it does mean the report should present information in a manner easily accessible to both groups.

If you're creating a series of reports, you'll also want to think ahead of time about the formatting. Using the same style for each report in a series gives you a uniform, more professional appearance. To accomplish this, you can use common headers and footers to indicate such items as your company or product's name, the report's name, and the current page number. Although adding or changing headers and footers is easily accomplished using a report designer, making such changes to the 40 reports you've already created can be tedious and frustrating. It's much easier to set your report up correctly from the start.

EXPERT HELP

Now let's create a report. You create a new report with Crystal Reports by choosing the *File | New* menu option in your report designer. When you do this Crystal Reports presents you with four ways to create a new report: using a report expert, using an existing report as a template, importing and converting an existing text report, or simply creating an empty (blank) report.

FIGURE 1: *Seagate Crystal Reports offers a variety of experts to help you create a new report.*

Of the four approaches, using a report expert offers the simplest and quickest route. Crystal Reports provides experts for creating eight basic types such as standard reports, mailing labels, form letters, and so forth, as shown in Figure 1. Each is available by choosing the appropriate button. For example, pressing the *Standard* button presents you with the standard report expert shown in Figure 2.

Each expert contains a series of pages that correspond to the steps you'll follow to create a report. Because each step usually depends on the previous one, at each level you may have to make decisions before proceeding to the next. For example, the standard report expert won't let you move from the first page until you specify the data files your report will use.

Incorporating data files into reports is a fairly simple task, since Crystal Reports sup-

ports a number of databases, both through its own native mode drivers as well as through ODBC. Its broad range of database support covers not only all of the popular relational databases but also newer data-storage methodologies such as online analytical processing (OLAP) and multidimensional data. All you need to do is choose the appropriate database type and use the file-selection dialog to select the database file. When you're done, press the *Next* button to move to the *Field* page (see Figure 3), which not surprisingly lets you select the fields you want to include in your report. You can specify fields individually by selecting them from the list and pressing the *Add* button, or you can press *Add All* to add all of the fields to your report.

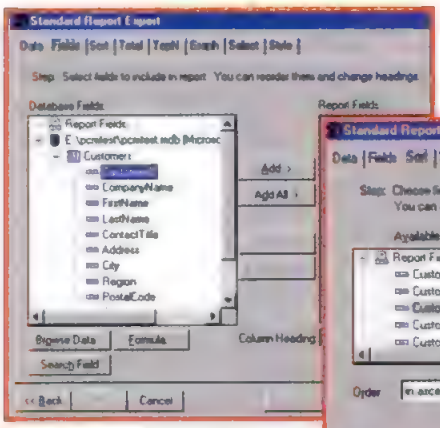

FIGURE 3: *You can select the fields you need using the expert's* Fields *pages.*

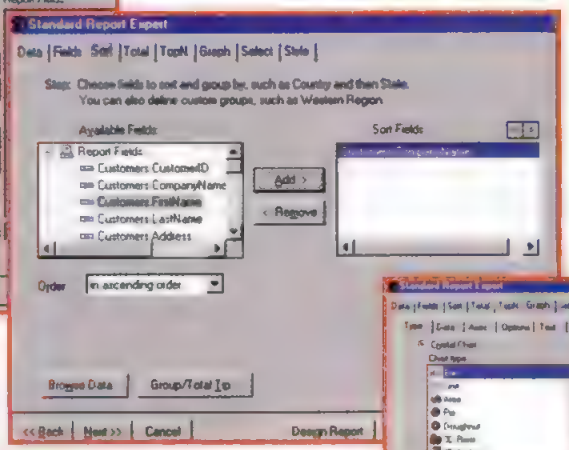

FIGURE 4: *The* Sort *page lets you choose fields by which to sort the data in your report.*

GETTING THINGS IN ORDER

After adding the fields, you'll want to specify the order in which the corresponding records are displayed. You configure this aspect of your report using the report expert's *Sort* page (see Figure 4). You can select one or more fields to use as sort keys. For example, if your report shows a list of customers, you can select the customer's name as a sort field so that records are listed alphabetically by customer name. Crystal Reports lets you use multiple fields for sorting, so you can sort by customer name and location if you wish.

Crystal Reports also lets you sort data by *Groups*. Groups offer the same sorting capabilities fields do, but you can also use them to provide a logical point for summarizing and totaling data. The report expert's *Total* page helps you create total fields for any of the numerical data fields your report contains. For example, suppose your customer database contains a numeric field called *Customer Purchases* that indicates the dollar amount each individual customer spent. If you select the *Customer Purchases* field on the *Total* page, Crystal Reports will automatically insert a total field into your report that represents the customer's total purchases. When you initially select a new total, the field's default behavior is to calculate the total by summing amounts. If you need more sophisticated totaling techniques, you can use the drop-down box located under the *Total Fields* list to select advanced totaling types such as averaging, minimum value, and maximum value, as well as various statistical calculations such as standard deviation and weighted averages.

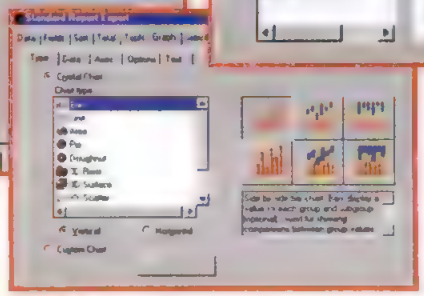

FIGURE 5: *Crystal Reports offers many styles of graphs to include in your report.*

ALL DRESSED UP

If your data could benefit from a graphical representation, you can use the optional *Graph* page to accomplish this. Crystal Reports offers an impressive selection of graph styles (see Figure 5), each available in both 2-D and 3-D versions, and you can graph your report's various numerical fields as well as any total fields you've created.

To get the maximum effect , you'll want to dress up your report by adding elements such as lines, graphics, special fonts, and so forth. The report expert's final *Style* page can help (see Figure 6). Several predefined styles are available, each offering a unique way to enhance your report's data presentation with a combination of shading, underlining, and font styles. Once you've settled on a particular style, press either the *Design Report* or the *Preview Report* button to create the new report. At this point the expert exits and loads your report into the report designer, which displays it as requested, in either design or preview mode.

REPORT DESIGNER BASICS

Up to this point we've been fairly isolated from the details of how the report is structured. That's because the report expert did a good job of collecting necessary information while hiding the grunt work associated with creating reports. Though experts simplify the task of basic report creation, you'll likely want to customize the final product using the designer's report-editing capabilities.

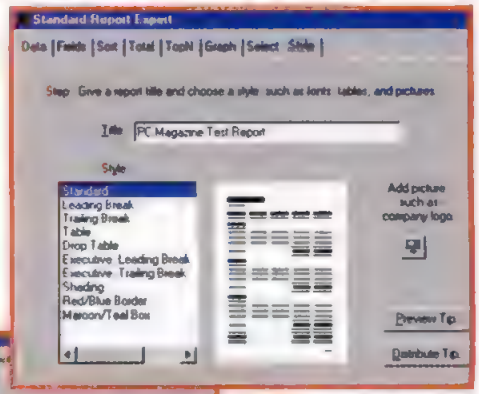

FIGURE 6: *The* Style *page puts the finishing touches on your report's appearance.*

The main window of Crystal Reports' report designer is composed of two panes of information (see Figure 7). The left side shows the various sections a report might include. You can use sections to group common information and to control when and where information is displayed. A number of predefined sections are available, but you can choose to eliminate any one by selecting the *Suppress* option in the section's properties.

The section located at the report's top is the *Report Header,* which typically holds items such as the report's title, the current date, and a company logo or letterhead. Information placed in the *Report Header* prints only once per report, on the report's first page. Just below is the *Page Header,* containing information that will appear at the top of subsequent pages, for example the current page number and a smaller version of the title.

The *Details* section contains repetitive data. For example, our customer report's *Details*

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section might contain a list of customers. Unlike the report's other sections, this one is printed multiple times, depending on the number of records in your database. If you've chosen to total data items, you'll also see one or more *Group* sections surrounding the details section. You can add or configure group sections as you wish, but keep in mind that changing group order can affect totaling, because it changes the order in which related records display.

The report designer's main window contains the page-size design area. Here you can drag fields to new locations and add or remove fields using the *Insert* menu option. You can add or arrange fields in either a free-form or fixed manner; each section's *Free-Form Placement* property controls that section's current mode.

With free-form placement you can place fields anywhere in a section, no matter how other fields are aligned. If you wish to align groups of fields, you can add *guidelines* to automatically snap adjacent fields to the same row or column location. In fixed mode, the report designer creates guidelines for you and snaps newly added fields to the closest one. Guidelines work much as tabs in a word processing document do. For example, if you add tabs to a document and align paragraphs on a particular tab mark, you can move the paragraphs to a new location simply by dragging the tab marker. Although guidelines work in a similar fashion to tabs, they're a little more flexible, because they let you align fields in rows as well as columns.

Most modern report designers offer a built-in formula language that is completely integrated, giving the language full access to report data.

It's easy to add new database fields to a report with the *Insert | Database Field* menu item. And you can even decide to add a new database using the *Add Database to Report* option. If your report uses more than one table, you'll need to specify the key relationships that exist between each of the tables. You can use the Visual Linking Expert to describe these key relationships visually.

To add graphical objects to a report, select the appropriate object type from the *Insert* menu. Crystal Reports supports several categories of graphical objects, such as lines, boxes, charts, and images in BMP, JPG, PCX, TIFF, and TGA formats. You can also embed OLE objects into reports, because Crystal Reports serves as an OLE object container. The *Insert | OLE Object* menu item presents a list of registered objects you can insert into your report.

A new feature in Version 7.0 is the ability to add geographical maps to reports. The Map Expert helps you create these maps, which you can associate with your report's data. You could use this feature, for example, to print not only a textual list of customer states but also a graphical representation, in the form of a U.S. map with pinpoints indicating each customer's location.

FORMULA FOR SUCCESS

For some reports, all that's needed is simply adding a few database fields and tossing

Other Choices

Although market-leading Seagate Crystal Reports offers many advanced reporting capabilities, it's difficult for any one tool to meet everyone's needs. For this reason, we looked at seven other tools you may want to consider.

ActiveReports 1.0 ($399 list), from Data Dynamics, provides a broad range of reporting capabilities for Visual Basic developers. Its report designer is tightly integrated with Visual Basic's IDE as an ActiveX designer, and you can use Visual Basic code in its formulas. If Visual Basic is your language of choice, ActiveReports is certainly worth a look. (Data Dynamics Ltd., Columbus, OH; 614-895-3142; *www.datadynamics.com.*)

Wall Data offers two products for report building. **R&R Report Writer Xbase Edition** ($299 list) provides good reporting capabilities for Xbase databases, including Clipper, FoxPro, and dBASE III, IV, and V. Its report designer is easy to use and includes charting and a scripting language for additional functionality. The designer is also used by **Arpeggio Information Publisher** ($495), which offers all the capabilities of R&R Report Writer but adds broader database support and host connectivity. If you're building enterprise applications, Arpeggio's host connectivity options make it worth considering. (Wall Data Inc., Westboro, MA; 800-325-9035; *www.walldata.com.*)

Software FX's **Report FX** ($289 list) offers excellent graphing capabilities, but the tool is unfortunately hampered by several flaws. Though in fact the product offers many of the features found in other tools, they are obscured by the rather abbreviated and poorly written user manual. Even worse, its sample programs are two full versions behind the latest releases of Visual Basic and Visual C++. (Software FX Inc., Boca Raton, FL; 800-392-4278; *www.softwarefx.com.*)

Seagate Info is Crystal Reports' more advanced sibling (five-user designer module, $1,975 list; five-user client license, $1,475). It uses the same powerful report designer but adds an extensive array of enterprise data tools for security, report scheduling, and so forth. This very comprehensive product comes with a huge stack of manuals and is much more challenging to learn than its sibling, but it's the tool of choice for the enterprise. Interestingly, at press time Seagate announced an initiative in the business-intelligence market, in which it is offering two products for free to organizations, either via the Web or a CD: a 50-user license for Seagate Info 7 and Seagate Analysis, a new query and reporting tool. (Seagate Software Inc., Vancouver, Canada; 800-877-2340; *www.seagatesoftware.com.*)

VideoSoft's **vsReports** ($149 list) and **vsView** ($249) offer variations on the traditional approach, which combines a report designer with a print/view engine. vsReports provides a print engine capable of displaying and printing Microsoft Access 95 or 97 reports, effectively letting you use Access as your report designer. vsView is a collection of ActiveX controls that offer enhanced printing/viewing capabilities. DataReporter, which is also included in the package, is a simple but capable report writer, which you can distribute royalty-free with your applications. (VideoSoft, Emeryville, CA; 800-228-4839; *www.videosoft.com.*)

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9.1GB	7200	Quantum	XP309100S	$359
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some text headers over them. Others require data manipulation, rather than just displaying each field exactly as it's contained in the database. For example, let's consider a simple case where you want to use two database fields containing a first and last name in a form letter salutation, such as *Dear John Smith*. It's easy enough to insert the two fields using the report designer, one field after the other, but when you run the report, the result may be unsatisfactory. The problem is text fields are variable in length but report fields use a fixed length. You have to leave enough room between adjacent fields to allow for the longest field's contents. Basically this means that when you insert the first name field you can't simply leave enough space for the name *John*, you must also allow space for longer names such as *Elizabeth*. Of course once you've done this, your salutation line for *John Smith* ends up displaying extra space after the first name, which doesn't result in the professional appearance that was your goal.

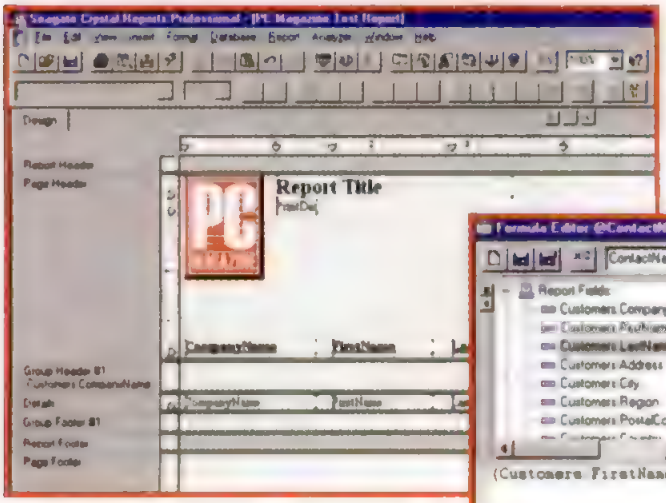

FIGURE 7: *The report designer's main window contains a section pane and a design pane*

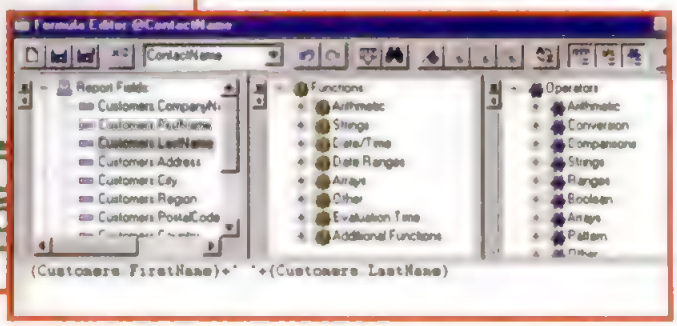

FIGURE 8: *Crystal Report's formula language gives you extra flexibility, and the formula editor makes using it a snap.*

Back in the days of code-based reporting, developers typically wrote routines to handle special cases such as this. There are many times when the flexibility offered by a programming language can really come in handy. It's for this reason many modern report designers offer built-in *formula* languages. Most are complete programming languages that include functions, logical operations, and variables. But unlike programming languages, they're completely integrated into reporting tools, which gives them full access to your reports' data. The formula language included with Crystal Reports is a clear example of the power afforded by an integrated programming language. Its syntax combines aspects of Basic, C, and Pascal. It contains logical constructs such as if-then statements as well as nearly 100 functions for string manipulation, complex math calculations, date/time calculations, and so on. If you can't find a function that suits your needs, you can even add your own by placing them into special user function DLLs.

Formulas are created and modified using the *Formula Editor* (see Figure 8). You can type in a formula's code directly or choose its elements from one of several field and function lists. The formula language is easy to get used to, especially if you're familiar with C, Pascal, or Basic, but there are a few things to keep in mind. One in particular is that database field names are *always* surrounded by braces. For example, a *Customer* table's *LastName* field appears as `{Customer.LastName}` in a formula.

Note also the distinction between equality and assignment operators. The formula language uses the statement `If (a = b) then…` to compare two values; the statement `a := b` assigns `a` the same value as `b`. As you can see, Crystal Reports uses a single equals sign for comparing values and a colon with an equals sign for assigning values. Although Pascal developers will feel right at home with this syntax, Basic and C developers might find themselves scratching their heads wondering why a particular formula isn't working—only to find they mistakenly left out the colons.

In addition to equality and assignment operators, the formula language also supports the plus operator for combining string fields, thus providing the solution for our first/last name problem. This statement

```
{Customer.FirstName}+"
"+{Customer.LastName}
```

takes the customer's first name and adds a space followed by the customer's last name. The result is a name in the form *John Smith*—exactly what we were after. The final step is to add the new formula to the form letter's salutation line using the report designer's *Insert | Formula* menu option.

INCORPORATING THE PRINT/VIEW ENGINE

Crystal Reports supplies a print/view engine packaged in several forms, including 16-bit or 32-bit ActiveX controls and 16-bit or 32-bit DLLs. There's also a VCL control for Delphi and a VBX control for older 16-bit versions of Visual Basic. MFC developers will find a bonus in the form of an MFC-based C++ class that interfaces with the engine routines.

The steps required to incorporate the engine into your application depend on which control you choose. For example, using the ActiveX engine control in a Visual Basic or Visual C++ application is simply a matter of adding it to the current project. Once you've incorporated it, you can add the control to a form to gain access to events and properties. Many properties such as the report's file name and destination (screen, printer, or file), can be configured both at design and at runtime. When printing reports to files, Crystal Reports offers an impressive selection of output formats, such as HTML, ASCII text, Word document, and Excel spreadsheet.

The process of adding the engine to an application is fairly painless, though taking full advantage of the large number of properties and events in the control requires some work. Unfortunately, you'll have to rely on online help for guidance, because Crystal Reports' user manual covers only the report designer. Fortunately, a good collection of sample programs demonstrate how to use the engine with various languages.

Seagate Crystal Reports Professional 7.0. $395 list. Seagate Software Inc., Vancouver, Canada; 800-877-2340; *www.seagatesoftware.com.*

Steven E. Sipe is a developer based in Wilmington, North Carolina, and a frequent contributor to PC Magazine. PC

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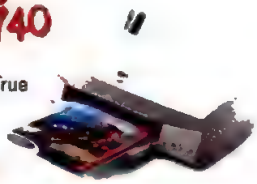

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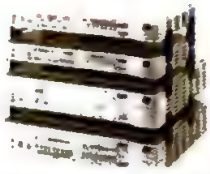

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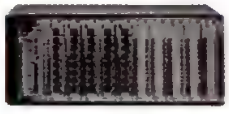

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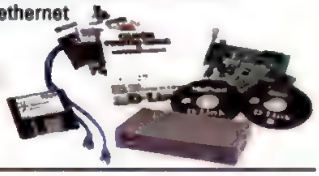

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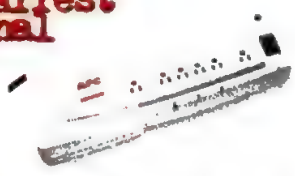

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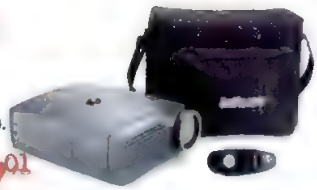

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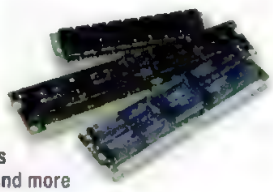

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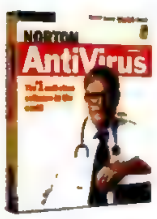

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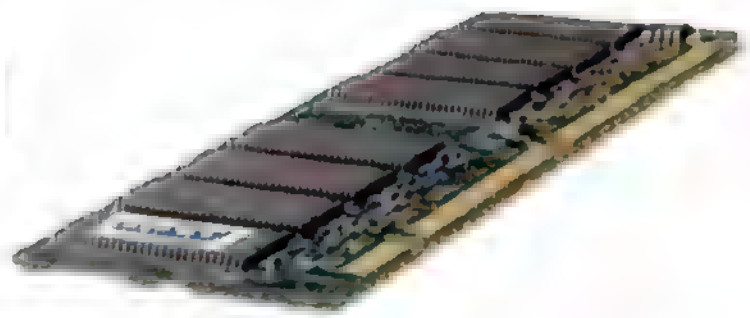

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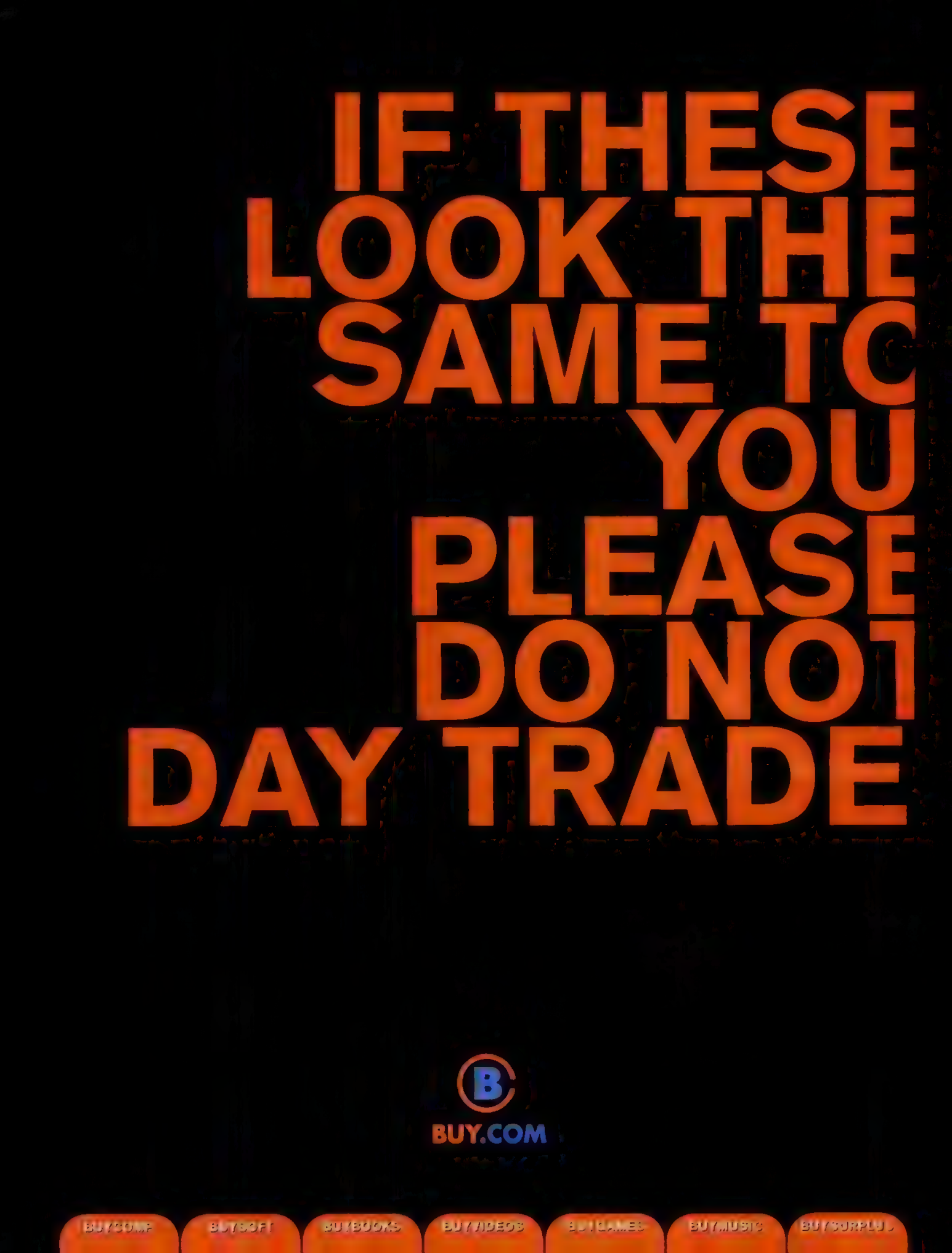
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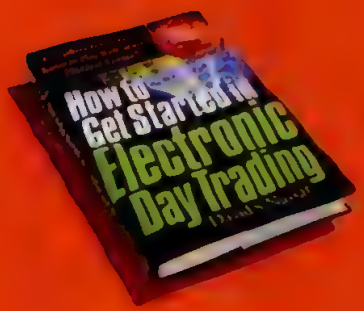

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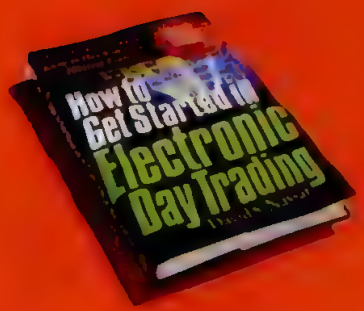

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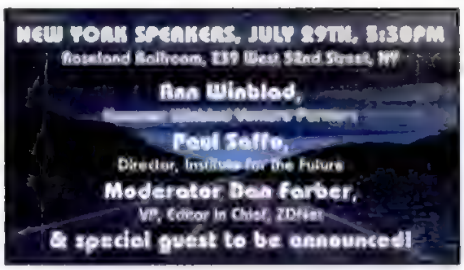

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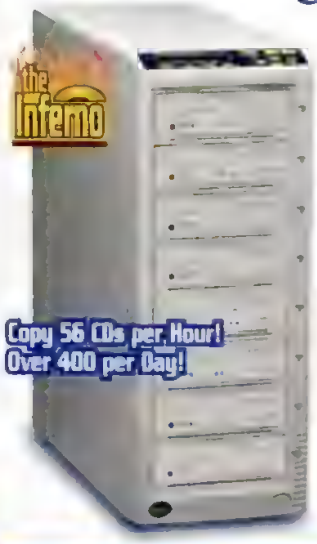

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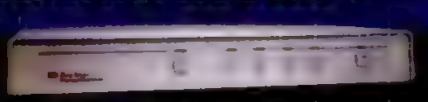

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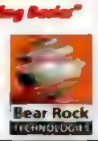

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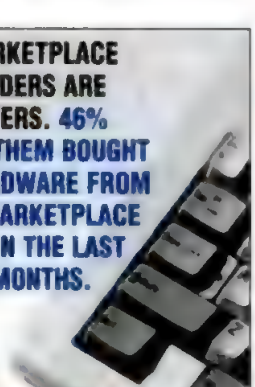

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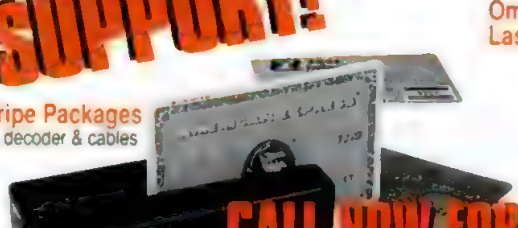

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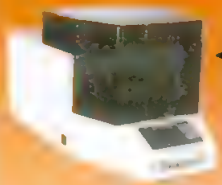

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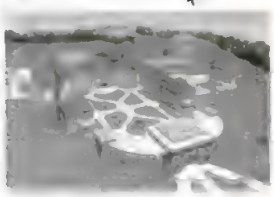

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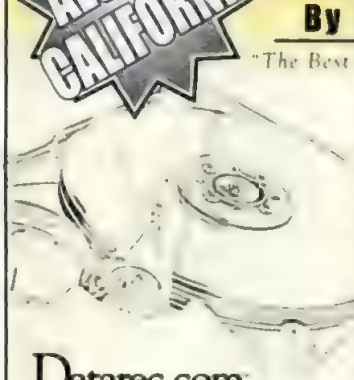

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3-D GAMING

Games Get Real

By Michael E. Ryan

Hardware-accelerated 3-D graphics are sweeping the computer game industry. Sure, 3-D graphics have been around since DOOM and even Castle Wolfenstein 3D, but never have so many games made special use of such powerful 3-D accelerators and instruction chip sets as AMD's 3DNow! and Intel's 3-D extensions for the Pentium III.

Once a gee-whiz technology limited to hard-core gamers, 3-D acceleration now pervades every gaming genre. And though souped-up 3-D graphics have long been an optional enhancement, many games now require 3-D accelerators to run at all. In fact, of the nine games we review here, six require 3-D hardware: EverQuest, Jane's Fleet Command, Machines, Rollcage, and the two Star Wars *games, Star Wars: Episode I: The Phantom Menace and Star Wars: Episode I: Racer.*

For this roundup, we selected nine recently released 3-D titles to see how each implements hardware acceleration and how graphics enhancements add to the game's value. For each title, the golden rule of gaming holds true: Game play is the bottom line, regardless of how pretty the graphics may be. In other words, 3-D is just one of the many elements that make up these games. The ability to run in 3-D is now taken for granted by developers, which means hardware-accelerated imagery is no longer an option for game players—it is a requirement.

EverQuest

EverQuest is a massively multiplayer online role-playing game set in a persistent fantasy-themed universe. Quite a mouthful, but all it means is that the game lets you create and control a character in a sword-and-sorcery online world that continues to function even when you are not logged in. Much like Origin's Ultima Online, EverQuest is a game of social interaction and adventure with a killer 3-D engine to boot.

After you install EverQuest and set up an online account (which costs $10 per month beyond the CD-ROM's $50 street price) you can create a character in the online world of Norrath. Fans of J.R.R. Tolkien and Advanced Dungeons and Dragons will have little trouble here, as the game provides a host of familiar races and character classes to choose from. For example, you can play the game as a half-elf ranger or a halfling thief, among other combinations.

Once your character is set, you can embark on your journey into Norrath. Fortunately, EverQuest is much friendlier to new players than Ultima Online. For starters, you will not encounter any player-killing problems in EverQuest: Player-versus-player combat can occur only on servers set aside for that purpose. Also, other players can't loot your corpse until a lengthy grace period has elapsed, so you can retrieve your stuff when you die (and you will die—a lot).

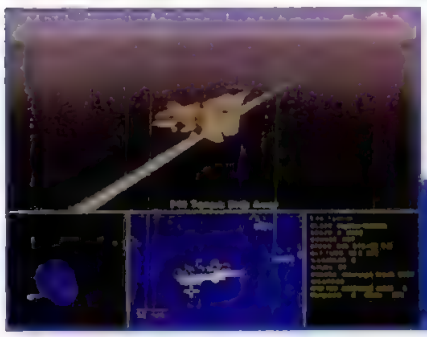
The goal of the game is to build up your character by gaining experience. You do this by killing the not-so-friendly creatures roaming the lush 3-D land-

ILLUSTRATION BY JOHN SLEDD

scapes of Norrath. Your character starts out rather feeble, so you must battle snakes and bats before moving on to more dangerous prey. Be warned: You will have to work long and hard to improve your character.

Luckily, EverQuest is designed with social interaction in mind. So if you team up with like-minded (and like-skilled) players, you can liven up the repetitive early stages of character development and meet friends who can help with more dangerous adventures down the road.

EverQuest is the best online role-playing game available. If you're looking for a game that promotes teamwork and can occupy several hours per day, EverQuest is a good fit.



JANE'S FLEET COMMAND
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Jane's Fleet Command

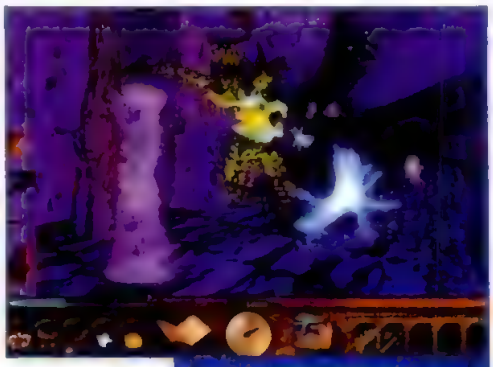
A strategy game in the Harpoon tradition, Jane's Fleet Command challenges players to command modern naval forces in single missions and lengthy campaigns around the globe. Slick use of 3-D graphics adds a bit of flash to the game, but the real value of Jane's Fleet Command lies in the well-designed features of the game and the addictive naval strategy action.

Jane's Fleet Command lets you take charge of a single vessel, a task force, or an entire fleet (hence the name). The game offers a series of hypothetical campaigns set around U.S. responses to expansion moves by China, Russia, and India. In each campaign, you must complete a sequence of related missions in order to deter or destroy the enemy forces involved.

Most of the game is played and viewed on a large, 2-D map of the world, which shows each conflict's region and can be zoomed in and out for easier viewing. As you click on and select a unit under your command, you will see a 3-D image of that unit as it moves along its path. The 3-D images are extremely detailed, as a quick glance at an aircraft carrier will show you. The planes move around the flight deck of the carrier, launch when ordered, and even ascend on huge elevators when you need to scramble an "alert 5" aircraft. These 3-D images add an element of excitement to the sterile, 2-D map interface.

Game play can be quite challenging, as most of the game's scenarios are tough to win in one try (even the so-called easy ones). Keeping track of all of your units on the 2-D map can be difficult, as they often overlap. Zooming in helps, but then you can't see the whole battle as it unfolds.

Still, a little practice (and the game's excellent tutorials) will familiarize you with the interface. After that, the addictive game play in Jane's Fleet Command will keep you coming back.



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Lands of Lore III

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The Future of 3-D Gaming

The Electronic Entertainment Expo (E3), held mid-May in Los Angeles, is the year's showcase event for game developers. Here are five of the most promising 3-D games from E3 due out later this year.

One of the most impressive games at E3 this year, **Amen: The Awakening** is a first-person action/adventure game that promises to deliver stunning visuals and superb game play. Players take on the role of Bishop 6, a British agent caught in a disturbing worldwide crisis. The game will allow multiple paths through most areas, and the enemy's artificial intelligence will react differently each time you play. Amen: The Awakening should be available in time for the holidays. (Cavedog Entertainment, 800-610-4847, *www.cavedog.com.*)

An epic game of interstellar combat, **Homeworld** is a unique, real-time strategy game. Rather than using the traditional top-down system employed by most games in the genre, Homeworld plops you right into the 3-D universe to command a massive space fleet through enormous battles. The graphics are spectacular, and the design is solid. We expect Sierra to release Homeworld by late summer or early fall. (Sierra Studios, 800-757-7707, *www.sierrastudios.com.*)

Following up the hugely successful Quake II, id Software is putting the finishing touches on **Quake III Arena**. This game will be designed almost exclusively for multiplayer action, though there will be a single-player component included. As with Quake and Quake II, the 3-D graphics engine in Quake III will revolutionize the industry. Expect Quake III Arena to ship by late summer or early fall of this year. (id Software Inc./Activision Inc., 310-255-2000, *www.activision.com.*)

Another Activision title, another great-looking first-person game. In **Star Trek Voyager: Elite Force**, players join the Voyager's crew in a struggle against the Borg. Based on Quake III's 3-D graphics engine, Elite Force has impressive graphics that look amazingly like the settings on the TV show. The game also features a nonlinear level structure and a host of multiplayer options. Look for this game around the end of the year. (Activision Inc., 310-255-2000, *www.activision.com.*)

Universally hailed as one of E3's showstoppers, **Vampire: The Masquerade** is a great-looking role-playing game in which you assume the role of a good vampire who must battle evil vampires through several time periods and locations. The graphics are superb, and the level of detail in the characters is simply amazing. Game play will be similar to most role-playing games, with plenty of story and character development, but it will also include a ton of action. Look for Vampire to ship in time for the holidays. (Activision Inc., 310-255-2000, *www.activision.com.*)

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playing games rely heavily on story and character development to draw players in and create an enticing game experience. Graphics tend to be a secondary consideration. Lands of Lore III follows this formula, utilizing a dated, clunky 3-D engine that *might* have looked good way back when Duke Nukem 3D hit the scene.

Unfortunately, Lands of Lore III can't overcome its mediocre graphics with other elements. The story is decent enough for the genre: You play Copper LeGré, heir to the throne of Gladstone, who suddenly finds himself without a soul. To save his newly inherited kingdom from the sinister forces threatening the land and its people, Copper must travel to five other worlds, solving quests along the way and eventually recovering his soul.

Game play is fairly typical,

with you guiding Copper through the land of Gladstone (where the game begins) and the five other worlds. You'll have to talk to a handful of characters and slay some beasts along the way, but Lands of Lore III does not go out of its way to challenge you. Compared with a role-playing classic such as Baldur's Gate, from Interplay Productions, Lands of Lore III feels simplistic—like role playing lite.

To top things off, the game is unstable on many systems, and several basic game elements (such as feeding Copper) are tedious and annoying. The music and sound effects are good, but these alone can't save the otherwise lackluster effort.

Lands of Lore III might appeal to casual fans of role-playing games, who care little for good graphics and enjoy action-oriented puzzle solving. Otherwise, there are far too many good role-playing games out or forthcoming to waste time with this one.

Machines

Once reserved for the action and sports games of the world, 3-D graphics have now broken through to the strategy genre. Similar to WarGames and WarZone 2100, Acclaim's Machines adds a 3-D engine to a typical real-time strategy design.

In Machines, each player controls an army of robot units and competes by building bases, researching technologies, harvesting resources, and fighting any opposition. The game's excellent 3-D engine adds a great deal of flash to this tried-and-true formula. Beautifully animated units and buildings, colored lighting, and a host of dramatic weapons effects help liven up the Machines landscape.

Additionally, players can switch perspectives during the game, jumping from an overhead view to a ground-level view and even to a first-person view from inside any active unit. Unfortunately, this nifty feature impedes your ability to command and control your forces, which are most efficiently managed in the overhead view.

That's just the start of the problems. Though the game does a good job of creating a 3-D version of Command & Conquer, Machines brings nothing new—or of substance—to the table. If you've played any recently released real-time strategy game, you'll find Machines all too familiar. More similarities lie in the game's poor artificial intelligence and pathfinding algorithms. The computer-controlled forces almost always use the same tactics when attacking your forces, and your own units often get confused, hung up on the terrain, or just plain lost.

Although Machines might appeal to hard-core strategy fans who haven't yet tired of the same old scenario, the game does not figure to capture the hearts and minds of computer gamers in general. It's all been done before, and it's all been done better.

Rollcage

Rollcage is one of the most original racing games we've ever seen. Set in the distant future (with little background to establish the story), the game challenges you to drive an acrobatic vehicle around a series of elaborately detailed tracks. Your car can drive over and through most objects in its path, and it can maneuver perfectly whether upright or upside down. The result is a good but often confusing racing game.

The game includes 20 tracks, each of which is lavishly rendered in 3-D. The graphics in Rollcage are spectacular all around, but the cars are rather slablike in their appearance. Best of all, the tracks are "interactive," as you can bulldoze your way right through many of the buildings and structures in your path. The resulting rubble can slow down or wipe out your opponents, so you have some incentive to drive recklessly. Also, each track is littered with power-ups, such as missiles and turbo boosts.

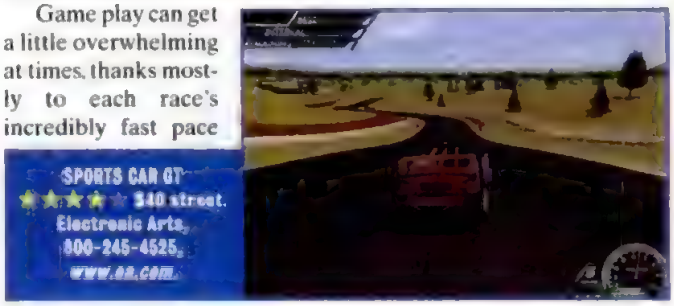
Game play can get a little overwhelming at times, thanks mostly to each race's incredibly fast pace and your car's tendency to flip around so much that you can no longer tell which way you should be going. Nevertheless, Rollcage is a fun game that can be very addictive. Kudos to the design team for creating something new in a genre of all-too-similar titles. Rollcage isn't for everyone (anyone susceptible to motion sickness should stay far away from it), but it is a solid, enjoyable racing game with a nice twist.

Sports Car GT

PC MAGAZINE EDITORS' CHOICE

Our Editors' Choice is a solid car-racing game from Electronic Arts, Sports Car GT, which challenges players to compete in the GT (short for *grand touring car*) racing series. Players start out in the low-level GTQ qualifying circuit, enhancing their cars and moving up through the more advanced circuits with each win.

Sports Car GT offers a quick-race feature, or you can choose career mode, which lets you move up the ranks of the GT series. You begin career



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mode with access to only three types of cars, but the game actually includes more than ten. You unlock better cars as you move from the GTQ circuit to GT3, GT2, and finally GT1. Several cars are hidden and will become available only if you win a racing season at the highest difficulty settings. Similarly, you begin the game with access to four tracks, but more become available as you progress and unlock the hidden ones.

With each win, you accumulate prize money, which can be used to enhance your car. You can eventually ditch your starter car for a better model, but for the early going you must concentrate on making your first car better, faster, and a lot more maneuverable.

The 3-D graphics in Sports Car GT are impressive. Each car is well rendered, and the tracks are beautifully detailed. Subtle touches make the settings more realistic, such as excellent distance rendering that eliminates the ugly "wall of fog" effect that is employed by so many other racing games.

Sports Car GT is impressive under the hood as well. The physics behind the game engine are fairly realistic, so you can't get away with arcade-style bump-and-run driving here. Also, if you hit a wall or another car your vehicle will become damaged, and its performance will be affected appropriately.

Sports Car GT is an excellent racing title that offers challenging game play with top-notch graphics. It's not easy to play, so racing novices may want to stick to lighter fare (such as Need for Speed III), but hard-core racing fans should find a lot to like in Sports Car GT.

Star Wars: Episode I: The Phantom Menace

Star Wars: Episode I: The Phantom Menace is a 3-D action game based on the blockbuster film of the same name. The game was released the same day as the movie and lets players fight their way through the familiar story line: Save the small planet of Naboo from the evil schemes of the Trade Federation. Played from a third-person perspective, The Phantom Menace resembles console-style games such as Resident Evil and Tomb Raider rather than first-person shooters such as Quake II or Star Wars: Jedi Knight: Dark Forces II. The game play is also similar to that in console games, with plenty of hand/eye coordination puzzles (such as difficult jumps) and other challenges that rely almost entirely on your reflexes.

STAR WARS: EPISODE I: THE PHANTOM MENACE
★★★☆☆ $40 street. LucasArts Entertainment Co., 888-532-4263, www.lucasarts.com.

The game is split into four parts, and you control a different *Star Wars* character in each one. You begin the game as Obi-Wan Kenobi, but you eventually play Qui-Gon Jinn, Queen Amidala, and Captain Panaka (fortunately, you don't have to play the role of Jar Jar Binks).

Using an impressive 3-D engine to re-create the settings from the film, The Phantom Menace is a great-looking game. Not only are the environments well designed and rendered, but the individual characters are also extremely well modeled and animated. The result is a faithful adaptation of the film on your PC.

This is not to say that the game and the film are identical, because they are not. The game follows a slightly different sequence of events than the movie. Some of this is due to last-minute changes to the film that could not be incorporated in the game. Also, you will find a number of areas where the game fills in scenes that the movie skims over quickly (Obi-Wan and Qui-Gon's escape from the Federation battleship, for example).

The game can be extremely challenging, and for some reason you cannot alter the difficulty setting, but The Phantom Menace is a solid game despite this. Fans of the movie will definitely want to check it out, as will any action fan who enjoys Tomb Raider–style games—though the game will spoil the ending for anyone who hasn't yet seen the film.

Star Wars: Episode I: Racer

The second of two games released in conjunction with the new *Star Wars* prequel, Star Wars: Episode I: Racer is a 3-D racing game that captures the excitement of the film's pod-racing sequence. In the game, players take part in thrilling pod races as one of 21 different characters, including Anakin Skywalker, as they vie for "best pod racer in the galaxy" status.

Racer includes 25 tracks, each a bit more challenging than the last. In fact, each track offers four circuits: amateur, semi-pro, pro, and invitational (which is open to players who win one of the other three circuits). As you might imagine, the amateur circuit is fairly easy, and the pro circuit is quite tough. The tracks on the invitational circuit are also extremely challenging.

Players begin the game with basic pods (each character in the game has his or her own). As you win races, you'll accumulate prize money, which can be used to upgrade your pod. Upgrades are crucial to the game, as the computer-controlled opponents will dominate the later tracks if you do not improve your pod along the way.

Game play is similar to that of a basic racing game, except your vehicle is a three-piece hovercraft that sails along at breakneck speeds over untamed terrain. The game's 3-D graphics are excellent and help create a very believable illusion of intense speed during the races. All of the pods are wonderfully detailed, as are the racers controlling them. The sound effects are great, too; opponents shout taunts and spectators buzz as you pass.

There isn't a lot of depth to Star Wars: Episode I: Racer—*Star Wars* license notwithstanding—but it is a very good racing game. And the excellent production values and the frenetic game play should appeal to any fan of the arcade racing genre.

STAR WARS: EPISODE I: RACER
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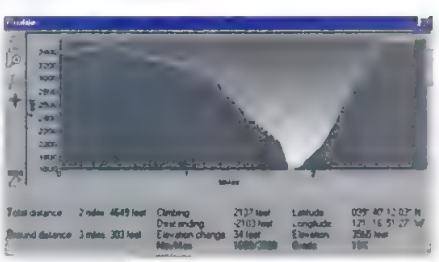

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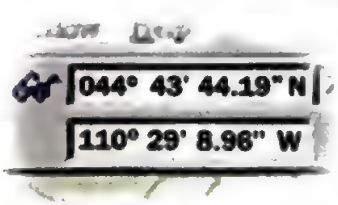

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Triple Play 2000

Electronic Arts' Triple Play 2000 may not be the most true-to-life baseball game on the market (the game's statistics are inflated, and the computer is not the smartest manager around), but it is a lot of fun to play. In terms of quality use of 3-D graphics, Triple Play 2000 outshines most of the competition by creating an immersive, lifelike baseball-playing atmosphere.

The game lets you play exhibition, season, home-run derby, and play-off games at three different skill levels. Season lengths can vary from 15 games all the way up to a full 162-game campaign. You can choose any one of the existing major-league baseball teams to control, or you can draft players and create your own team from scratch.

At heart, Triple Play 2000 is an arcade game, so the realism of the baseball action can be suspect at times. For example, the artificial intelligence does not always make the best decisions when it comes to pinch hitting for a pitcher or running the bases. Still, this game is designed to bring out baseball's exciting aspects; you can sit down to a quick game against the computer or a friend and hammer out six or seven home runs apiece. On that level, Triple Play 2000 delivers.

The game's most impressive feature is a robust 3-D engine that re-creates a very believable, TV-like representation of the sport. Players are wonderfully modeled and, although they may not be quite as realistically rendered as their Microsoft Baseball 2000 counterparts, move far better than in any other baseball game currently available. Each player runs, swings, slides, and celebrates fluidly. Players even chew gum and fling their bats in disgust when they strike out. Although the 3-D graphics do not make a great game all by themselves, Triple Play 2000 certainly benefits from the immersive and realistic environment these graphics help to create.

If you're a die-hard baseball fan who lives and dies by the statistics and strategy of America's pastime, Triple Play 2000 is not the baseball game for you. But if you're looking for an exciting, fast-paced arcade version of the sport with excellent graphics, Triple Play 2000 is the one to pick.

TRIPLE PLAY 2000
★★★☆☆ $40 street.
Electronic Arts, 800-245-4525,
www.easports.com.

Coming Up

What's in the Next Issue of *PC Magazine*

Personal and Corporate Security

The Internet poses a whole new set of security risks for both individuals and corporations. The cover story of our next issue will focus on technologies that help you use the Internet without putting your data at risk or forfeiting your privacy. We'll review utilities that help you stop malicious programs, take control of cookies, put e-mail under lock and key, block spammers, and manage a growing list of user names and passwords. And on the business side, we'll test tools that help protect your perimeter, including firewalls and intrusion detection programs.

Home PCs: An Undercover Report

Now that it's easy to find a home PC for under $1,000, how do you decide which outlet is best for you? We've sent "secret shoppers" to 15 of the most prominent retail, direct, and Web PC vendors to investigate their knowledge, helpfulness, and support and return policies. We'll also report where we received the most value for our hard-earned dollars.

Flatbed Scanners

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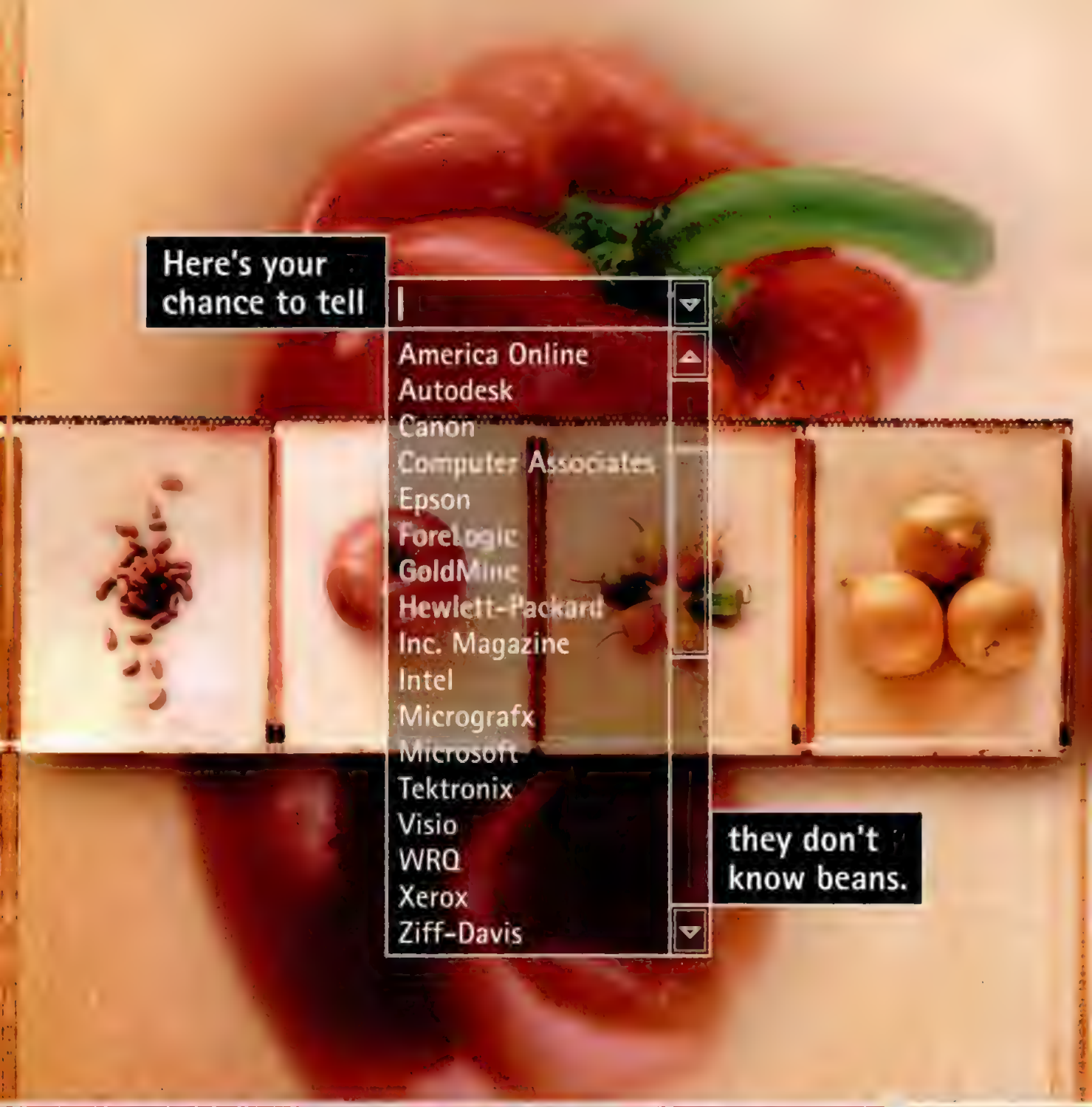

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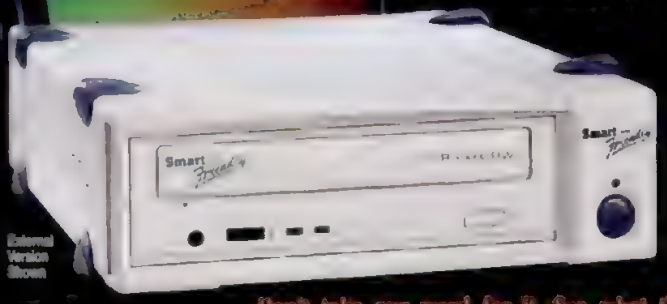

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CTSTM17C	AMD K6-2/350 3DNow!	17"	64MB PC 100	6.4GB UDMA	32X	AGP/8MB	AT/1MB Cache	Windows 98	$23/Month	$759.99
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CTSTM47	AMD K6-III/450 3DNow!	17"	128MB PC 100	19GB UDMA	40X	AGP/8MB	ATX/1MB Cache	Windows 98	$34/Month	$1129.99
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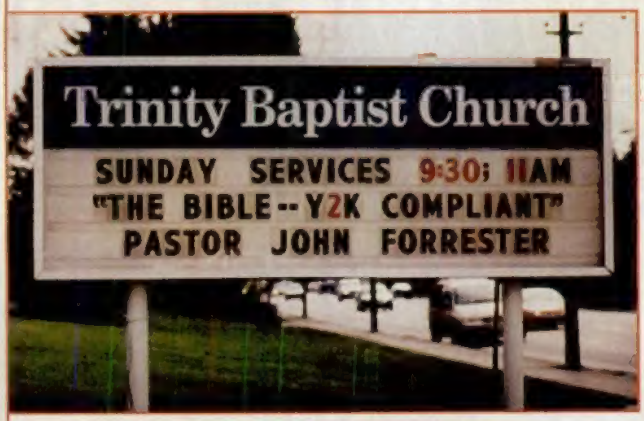

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